

MACHINE DESIGN

1969 ANNUAL INDEX

Volume 41—January to December

Including 26 regular issues of MACHINE DESIGN plus four special issues—*The Electric Controls Reference Issue, Seals Reference Issue, Fastening and Joining Reference Issue, Mechanical Drives Reference Issue*. Only articles and editorial items one-half page or larger are indexed.

AUTHOR INDEX

A

- Aaron, T. E. and Dr. Ronald Wolosewicz—"Electrochemical Machining," Dec. 11, p. 160
Allen, C. W.—"Pulse Operation of Solenoids," May 1, p. 170
Aronson, Robert
 "Riot Control," Jan. 9, p. 22
 "What Good is Holography?," Jan. 23, p. 36
 "Where Roads Don't Count," May 1, p. 36
 "River-Boat Design," July 10, p. 20
 "European Fighter Aircraft," Oct. 16, p. 44
Aronson, Robert and Nat F. Wood—"Nerva—Key to Deep Space Flight," July 24, p. 24

B

- Bannister, R. L. and D. V. Wright—"Prognosis with Plastic Models"
 Part 1: "Vibration and Deflection Study," Aug. 21, p. 134
 Part 2: "Scaling and Fabrication," Sept. 4, p. 136
 Part 3: "Instrumentation for Dynamic Testing," Oct. 2, p. 128
 Part 4: "Material Properties and Sample Study," Oct. 16, p. 178
Barnes, Sam
 "Boom in Bottom Bases," Feb. 6, p. 18
 "Grafting Men Together Again," Aug. 21, p. 21
Barry, John K.—"Quick-Operating Fasteners," *Fastening & Joining Reference Issue*, Sept. 11, p. 101
Bassett, G. L. and Frank Burt—"Manual Switches," *Electric Controls Reference Issue*, Mar. 13, p. 4
Baumgartner, Thomas C.—"How Fasteners Are Made," Jan. 9, p. 136
Bayer, R. G. and A. R. Wayson—"Designing for Measurable Wear," Aug. 7, p. 118
Bayer, R. G., A. T. Shaik, and A. R. Wayson—"Zero Wear," Jan. 9, p. 142
Becker, William E.—"Designing with Felt," June 26, p. 113
Belling, Thomas E.—"Electromechanical or Solid State?," July 24, p. 122
Benes, James J.
 "Automatic Assembly," Mar. 20, p. 193
 "Automatic Assembly," *Fastening & Joining Reference Issue*, Sept. 11, p. 129

- Benes, James J. and Lawrence C. Lynnworth—"Measuring Temperature," Nov. 13, p. 190
Bickford, John H.—"Technical Codes: The Language of Machines," Sept. 4, p. 108
Black, Frederick W.—"An Aerospace Industry Report on TPDT," Mar. 20, p. 177
Blandino, Edward P.—"Designing Torsion Springs," Mar. 6, p. 134
Bonneau, F. X.—"Counters," *Electric Controls Reference Issue*, Mar. 13, p. 59
Booser, E. R. and Richard C. Elwell—"Flat-Pad Thrust Bearings," Sept. 4, p. 141
Borcina, David M. and Jerome F. Smith—"Soldering and Soldering Alloys," *Fastening & Joining Reference Issue*, Sept. 11, p. 116
Boyce, H. L.—"Lip Types," *Seals Reference Issue*, June 19, p. 40
Boyd, Ellsworth—"Underwater Watchdogs," May 29, p. 31
Braendel, Felix W.—"Pin Fasteners," *Fastening & Joining Reference Issue*, Sept. 11, p. 70
Brenner, Harry S.—"Fastener Evaluation," *Fastening & Joining Reference Issue*, Sept. 11, p. 24
Breuer, George—"Analytically Magnified Gear Tooth Profiles," Feb. 20, p. 167
Brown, Harry K.—"SPARK For Keeping a Project on Schedule," May 15, p. 138
Brown, Paul L.—"The Failure of Functionalism," Dec. 11, p. 144
Burgess, John A.—"Organizing Design Problems," Nov. 27, p. 120
Burnett, J. R.—"Friction and Traction Drives," *Mechanical Drives Reference Issue*, Dec. 18, p. 30
Burt, Frank and G. L. Bassett—"Manual Switches," *Electric Controls Reference Issue*, Mar. 13, p. 4

C

- Carlock, Jack and Paul S. Strauss—"Common Sense Needs an Assist," July 24, p. 102
Carr, Houston H.—"Paper Work For Job Hunting," Aug. 7, p. 102
Cavasin, John, Jr.—"Designing Printed Wiring Boards," Jan. 23, p. 133
Chipman, Lester D.—"How the New Grads Measure Up," Sept. 18, p. 227
Chung, Jackson—"Shaft-Mounted Reducers," *Mechanical Drives Reference Issue*, Dec. 18, p. 41
Clarke, Emerson—"Government Information Sources," Oct. 30, p. 96

Collins, Gary W.—"Electric Motors," Jan. 9, p. 152
 Cook, D. V. and R. A. Hultin—"Build Your Own Analog Simulator," Aug. 7, p. 128
 Correns, H.—"Product Planning by Computer," Jan. 23, p. 161
 Corrigan, Michael and Lee Eichenseer—"Picking The Right Connector," Feb. 20, p. 162
 Cozzarin, Edward—"Mechanical Clutches," *Mechanical Drives Reference Issue*, Dec. 18, p. 43
 Crawshaw, S. L. and H. O. Kron—"Gears," *Mechanical Drives Reference Issue*, Dec. 18, p. 19
 Crews, Warren—"Digital Integrated Circuits," *Electric Controls Reference Issue*, Mar. 13, p. 71
 Curran, William—"Subminiature Lamps," Nov. 27, p. 134

D

Dombek, Edward K.—"Mechanical Brakes," *Mechanical Drives Reference Issue*, Dec. 18, p. 54
 Dankowski, T. P. and A. G. Lippert—"Computer Graphics" Part 1: "The Engineer and the CRT Terminal," Apr. 17, p. 227
 Part 2: "The Problems You Can Solve," May 1, p. 148
 D'Aprix, Roger M.
 "Building 'Show' Biz Into Technical Talks," Apr. 3, p. 127
 "Bridging the Communications Gap . . . from Your Side," Nov. 13, p. 189
 DeGeorge, William F.—"Ingredients for Successful Proposals," Apr. 3, p. 122
 Dibbern, Donald A. and V. E. James—"Stepping Switches," *Electric Controls Reference Issue*, Mar. 13, p. 47
 Doane, Russell C.—"Packaged Discrete Modules," *Electric Controls Reference Issue*, Mar. 13, p. 77
 Dreger, Donald R.—"Plastic Molding—or Metal Die Castings," July 24, p. 113
 Dreisliker, Henry—"The Polyphase Variable-Speed Commutator Motor," July 10, p. 130
 Duncan, Robert I.—"Eliminating Vanishing-Point Spread," Aug. 21, p. 139
 Dunkle, Heber H.—"General Types," *Seals Reference Issue*, June 19, p. 76

E

Ebel, Fred E.—"Read It Like It Is," Mar. 20, p. 175
 Eichenseer, Lee and Michael Corrigan—"Picking The Right Connector," Feb. 20, p. 162
 Esposito, A.—"Analyzing Hydraulic Circuits," Oct. 16, p. 173
 Elwell, Richard C. and E. R. Booser—"Flat-Pad Thrust Bearings," Sept. 4, p. 141
 Eshel, A. and L. Licht—"Foil Bearings," May 15, p. 154
 Everett, Malcolm H. and Howard G. Gillette
 "Squeeze Types," *Seals Reference Issue*, June 19, p. 47
 "Elastomeric O-Rings," *Seals Reference Issue*, June 19, p. 73

F

Fairbanks, Donald R., Malcolm H. Knapp, and Allan K. Lazarus—"Synthetic Lubricants," July 10, p. 140
 Farrow, John—"Limit Switches," *Electric Controls Reference Issue*, Mar. 13, p. 17
 Foster, Vance J. and Ralph E. Probert—"Armature Relays," *Electric Controls Reference Issue*, Mar. 13, p. 44

G

Gaster, Glenn R.—"Magnetic Couplings," Apr. 3, p. 147
 Gastineau, R. L. and J. E. Kalasky—"O-Ring Types," *Seals Reference Issue*, June 19, p. 82
 Gigliotti, O. V. and H. A. White—"Magnetization of Permanent Magnets," July 24, p. 128
 Gillette, Howard G. and Malcolm H. Everett
 "Squeeze Types," *Seals Reference Issue*, June 19, p. 47
 "Elastomeric O-Rings," *Seals Reference Issue*, June 19, p. 73
 Goldberg, B. W.—"A New Engineering Facility," Mar. 6, p. 125
 Goldberg, Leonard Z.—"V-Band Couplings," Apr. 3, p. 138
 Grundtner, Robert R.—"Couplings," *Mechanical Drives Reference Issue*, Dec. 18, p. 60

H

Hart, John—"Hard Chromium," May 15, p. 144
 Haasoun, I. A.—"Stress in Noncircular Shafts," July 24, p. 132
 Hay, A. Donald—"Cooling Enclosed Electronics," Mar. 6, p. 140
 Herzog, Raymond E.—"Promote Your Idea," Mar. 6, p. 122
 Heumann, Gerhart V.
 "Holography: What the Germans Are Doing," Sept. 18, p. 20
 "The Zeppelins Are Coming (Again?)," Oct. 2, p. 45
 Hibberd, Robert G.—"Basic Course in Integrated Circuits" Lesson 7: "Characteristics of Digital ICs," Jan. 9, p. 157
 Lesson 8: "Families of Digital ICs," Jan. 23, p. 163
 Lesson 9: "Elements of Linear ICs," Feb. 6, p. 153
 Lesson 10: "Basic Types of Linear ICs," Feb. 20, p. 169
 Lesson 11: "Standard Digital ICs," Mar. 6, p. 149
 Lesson 13: "Standard MOS and Linear ICs," Mar. 20, p. 215
 Lesson 14: "IC Applications, Present and Future," Apr. 17, p. 263
 Lesson 15: "ICs in Industrial Control," May 1, p. 187
 Hofmeister, William F.—"Roller Chain Ratings," May 29, p. 125
 Hopkins, R. Bruce—"Adapting Fatigue Data to Real Parts," June 12, p. 179
 Hormuth, Gustave A.
 "Resistance Thermometers," July 10, p. 136
 "Thermocouple Pyrometry," Aug. 21, p. 129
 Howard, Nelson G.—"Temperature Switches," *Electric Controls Reference Issue*, Mar. 13, p. 31
 Hultin, R. A. and D. V. Cook—"Build Your Own Analog Simulator," Aug. 7, p. 128
 Hurst, T. P. and D. P. Wagner—"Washers," *Fastening & Joining Reference Issue*, Sept. 11, p. 63

I
 Isenbarger, Robert O.—"Exclusion Devices," *Seals Reference Issue*, June 19, p. 10

J

Jacobs, George R., Jr.—"Documenting Printed-Wiring Packages," May 15, p. 166
 Jackson, Daniel B.—"Rotary Shaft Seals," June 12, p. 171
 Jalbert, B. W.—"Switching Transistors," *Electric Controls Reference Issue*, Mar. 13, p. 64
 James, V. E. and Donald A. Dibbern—"Stepping Switches," *Electric Controls Reference Issue*, Mar. 13, p. 47
 Jones, Roger F.—"New Developments in Fortified Thermoplastics," Nov. 13, p. 205

K

Kable, Herman—"Plan Promotes Productivity," Oct. 2, p. 102
 Kalasky, J. E. and R. L. Gastineau—"O-Ring Types," *Seals Reference Issue*, June 19, p. 82
 Karger, D. W. and R. G. Murdick—"Need-To-Know for the Manager-In-Training," July 24, p. 98
 Kauffman, Jack—"Hydraulic System Design" Part 1: "A Checklist Approach," Sept. 4, p. 118
 Part 2: "A Checklist Approach (cont.)," Oct. 2, p. 134
 Part 3: "Ensuring Thermal Stability," Oct. 30, p. 116
 Part 4: "Machine-Tool Traverse and Feed Circuits," Nov. 27, p. 144
 Part 5: "Control of Machine-Tool Feed," Dec. 25, p. 78
 Kear, Fred W.—"Sensing Suddenness," Aug. 7, p. 132
 Kirk, Roger—"Designing Tires For War," June 12, p. 46
 Kirkpatrick, Donald L. and William C. Young—"Dry-Lubricant Films," May 15, p. 163
 Khol, Ronald
 "High Pressure Forming," Jan. 9, p. 124
 "A-C Fluidics," Feb. 6, p. 126
 "Computer Matches Designer, Methods Man As Working Team," Mar. 6, p. 127
 "Forged Powder Metal," Apr. 3, p. 142
 "Adaptive Control," May 1, p. 156
 "The Electric Brain," May 29, p. 102
 "Parts From Aluminum Powder," July 10, p. 110
 "Optical Computers," Aug. 21, p. 117
 "Noble Motives and Rich Rewards," Sept. 18, p. 178
 "Optoelectronics—Part 1," Oct. 16, p. 156
 "Optoelectronics—Part 2," Nov. 13, p. 208
 Klein, Stanley
 "Just The Fax," Feb. 20, p. 20
 "Mechanizing the Mail," Mar. 20, p. 21
 "Technology for Learning" Part 1: "Machines That Teach," May 29, p. 20
 Part 2: "Anti-Boob Tubes," June 12, p. 30
 "Multiplexing Takes Off," June 26, p. 34
 "Technology's Privileged Offspring," Sept. 18, p. 199
 "Taming the Bomb," Oct. 16, p. 19
 "Take-Home Computer Terminals," Oct. 16, p. 52
 "The ABCs of CATV," Nov. 27, p. 20
 Knapp, Malcolm H., Donald R. Fairbanks, and Allan K. Lazarus—"Synthetic Lubricants," July 10, p. 140
 Koda, Arthur J.—"Mercury-Wetted Contact Relays," *Electric Controls Reference Issue*, Mar. 13, p. 40
 Kopecki, Ernest S.—"Formability of Stainless Steels," Feb. 6, p. 149
 Kron, H. O. and S. L. Crawshaw—"Gears," *Mechanical Drives Reference Issue*, Dec. 18, p. 19
 Krupka, R. M. and B. R. Mutyal—"Stress and Deflection," May 29, p. 129
 Kuchler, Theodore C.—"Clearance Seals," *Seals Reference Issue*, June 19, p. 13
 Kuhn, James P.—"Use Your QA Capabilities," Nov. 13, p. 174
 Kull, Francis R.—"Setscrews," *Fastening & Joining Reference Issue*, Sept. 11, p. 32

L

Landau, Ronald M.—"Engineering Standards for Small Companies," Oct. 16, p. 140
 Lavoie, Francis J.
 "Signature Analysis: Product Early-Warning System," Jan. 23, p. 151
 "Neutron Radiography," Feb. 6, p. 138
 "Laser Welding," Feb. 20, p. 136
 "Beyond Integrated Circuits," Mar. 20, p. 180
 "Laser Provides New Data on Impact," Mar. 20, p. 212
 "Time-Sharing Goes Analog," Apr. 3, p. 131
 "Roll-Forming Gears," Apr. 17, p. 233
 "Programs for Hire," May 15, p. 132
 "Lending Engineers," May 29, p. 92
 "Batteries," June 12, p. 163
 "Explosive Welding," July 10, p. 125
 "Trends in Gearing," Aug. 7, p. 104
 "Nondestructive Testing," Sept. 4, p. 122
 "Computers: 1969-1980," Oct. 2, p. 106
 "3-D Graphics," Oct. 30, p. 84
 "Used Computers: Big-time data processing at bargain-basement prices," Nov. 27, p. 115
 "What's Ahead for Stamped Plastics," Dec. 11, p. 149
 "Minicomputers," Dec. 25, p. 54
 "Variable-Stroke Drives," *Mechanical Drives Reference Issue*, Dec. 18, p. 33
 "Fluid Couplings," *Mechanical Drives Reference Issue*, Dec. 18, p. 52
 "Electric Brakes," *Mechanical Drives Reference Issue*, Dec. 18, p. 57
 Lazarus, Allan K., Malcolm H. Knapp, and Donald R. Fairbanks—"Synthetic Lubricants," July 10, p. 140
 Leonard, Milton
 "Trends in Electric Controls," *Electric Controls Reference Issue*, Mar. 13, p. 3
 "Proximity Switches," *Electric Controls Reference Issue*, Mar. 13, p. 21
 Licht, L. and A. Eshel—"Foil Bearings," May 15, p. 154

- Lippert, A. G. and T. P. Dankowski—"Computer Graphics"
Part 1: "The Engineer and the CRT Terminal," Apr. 17, p. 226
Part 2: "The Problems You Can Solve," May 1, p. 148
- Lipson, Charles—"Basic Course in Failure Analysis"
Lesson 1: "Failure of Parts," Oct. 16, p. 146
Lesson 2: "Planning For Strength," Oct. 30, p. 103
Lesson 3: "Failure Modes," Nov. 13, p. 222
Lesson 4: "Bending Fractures," Nov. 27, p. 140
Lesson 5: "Torsional Failures," Dec. 11, p. 186
Lesson 6: "Adhesive and Abrasive Wear," Dec. 25, p. 74
- Litant, Irving—"Conductive Plastics," Oct. 16, p. 168
- Lockwood, John P.—"Applying Snap-Acting Switches," Oct. 2, p. 122
- Lorvick, Robert R.
"High-Speed Gearing," Mar. 20, p. 186
"Base-Mounted Reducers," *Mechanical Drives Reference Issue*, Dec. 18, p. 58
- Loucks, John—"Mechanical Design of Permanent Magnets," July 24, p. 125
- Lujic, Ante—"Controlling Brushless D-C Motors," Oct. 30, p. 113
- Lynch, Gerald A. and Larry D. Mitchell—"Origins of Noise," May 1, p. 174
- Lynnworth, Lawrence C. and James J. Benes—"Measuring Temperature," Nov. 13, p. 190

M

- Malcolm, Glen—"Belt and Chain Drives," *Mechanical Drives Reference Issue*, Dec. 18, p. 27
- Marlowe, Donald E.—"The New Social Involvement," Sept. 18, p. 218
- Massey, Paul D.—"Cinch Nuts," *Fastening & Joining Reference Issue*, Sept. 11, p. 54
- Mathews, Al and G. R. McKillop—"Compression Packings," *Seals Reference Issue*, June 19, p. 35
- McCormick, H. E.—"Spiral-Wound Retaining Rings," *Fastening & Joining Reference Issue*, Sept. 11, p. 96
- McKillop, G. R. and Al Mathews—"Compression Packings," *Seals Reference Issue*, June 19, p. 35
- Metzger, Jack
"Checking Hydraulic System Performance," Feb. 6, p. 134
"Hydraulic System Maintenance," Mar. 20, p. 205
"Closed-Center Hydraulic Systems," Apr. 17, p. 239
"Hydraulic or Pneumatic," June 26, p. 126
"Synchronizing Hydraulic Cylinders," Aug. 21, p. 140
"Sequencing Hydraulic Cylinders," Nov. 13, p. 218
- Metzler, Albert—"Solid-State Relays," *Electric Controls Reference Issue*, Mar. 13, p. 35
- Mihaly, Michael F.—"Anchor Nuts," *Fastening & Joining Reference Issue*, Sept. 11, p. 51
- Miller, O. E.—"Wire-Formed Retaining Rings," *Fastening & Joining Reference Issue*, Sept. 11, p. 93
- Mitchell, Larry D. and Gerald A. Lynch—"Origins of Noise," May 1, p. 174
- Murdick, R. G. and D. W. Karger—"Need-To-Know for the Manager-In-Training," July 24, p. 98
- Mutyal, B. R. and R. M. Krupka—"Stress and Deflection," May 29, p. 129

N

- North, R. A. and John A. Quimby—"Diaphragm Seals," *Seals Reference Issue*, June 19, p. 56
- Nuernberger, Eldon L.—"V-Belts," *Mechanical Drives Reference Issue*, Dec. 18, p. 9

O

- Olson, Larry J.—"Trends in Mechanical Drives," *Mechanical Drives Reference Issue*, Dec. 18, p. 3
- Orgorkiewicz, R. M.
"Design for Battlefield Survival," Nov. 13, p. 36
"New Armor Materials," Nov. 27, p. 36
- Osgood, Carl C.—"High-Performance Bolt Material," May 1, p. 181

P

- Palkie, C. R.—"Vinyl Dispersion Coatings," Aug. 7, p. 115
- Parrish, F. W.—"Applying Power Logic-Triacs," Apr. 3, p. 149
- Pattee, H. E.—"Brazing and Brazing Alloys," *Fastening & Joining Reference Issue*, Sept. 11, p. 111
- Paulus, George—"Bonding Dry-Film Lubricants," Dec. 25, p. 68
- Pearce, Bert L.—"Chains," *Mechanical Drives Reference Issue*, Dec. 18, p. 5
- Pech, Joseph F.—"Electric Clutches," *Mechanical Drives Reference Issue*, Dec. 18, p. 47
- Petrie, E. M.—"High-Temperature Structural Adhesives," May 15, p. 174
- Petrus, Stephen and William A. Seitz
"Single-Thread Engaging Nuts," *Fastening & Joining Reference Issue*, Sept. 11, p. 48
"Caged Nuts," *Fastening & Joining Reference Issue*, Sept. 11, p. 53
"Spring Clips," *Fastening & Joining Reference Issue*, Sept. 11, p. 84
- Prahalls, C. P.—"Speech-Making for the Unaccustomed Engineer," Dec. 11, p. 146
- Prifogle, J. S.—"Picking a Power Cord," Dec. 11, p. 168
- Probert, Ralph E. and J. Vance Foster—"Armature Relays," *Electric Controls Reference Issue*, Mar. 13, p. 44

Q

- Quimby, John A. and R. A. North—"Diaphragm Seals," *Seals Reference Issue*, June 19, p. 56

R

- Rasmussen, Svein B.—"Practical Rotor Dynamics"
Part 1: "Geometric Properties of Rotors," Feb. 6, p. 142
Part 2: "Load/Deflection Relationship," Feb. 20, p. 157
Part 3: "Natural Frequencies & Critical Speeds," Mar. 6, p. 158

- Raudsepp, Eugene
"Games Engineers Play," Feb. 20, p. 130
"Engineers' Attitudes," June 12, p. 156
"Synetics," Oct. 16, p. 134
"What Causes Discontent?" Nov. 27, p. 109
"They'd Rather Stay than Switch," Dec. 25, p. 50
- Reid, H. F.—"Specifying Welding Electrodes," Feb. 6, p. 146
- Rice, Leslie R.—"Thyristors," *Electric Controls Reference Issue*, Mar. 13, p. 67
- Rieger, Neville F.—"Drive-Train Vibrations," July 10, p. 115
- Robbins, Paul H.—"The Engineer as a Professional," Sept. 18, p. 221
- Rosenberg, Roger L.—"Reed Relays," *Electric Controls Reference Issue*, Mar. 13, p. 38
- Ruder, William—"The Engineer's Image," Sept. 18, p. 225
- Rudy, John F.—"Welding and Welding Alloys," *Fastening & Joining Reference Issue*, Sept. 11, p. 104
- Ruffer, Walter F.—"Pressure Switches," *Electric Controls Reference Issue*, Mar. 13, p. 25
- Russo, Roland
"NEMA Control Relays," *Electric Controls Reference Issue*, Mar. 13, p. 50
"Contactors," *Electric Controls Reference Issue*, Mar. 13, p. 85

S

- Schaft, E. E.—"Resistance-Welded Fasteners," *Fastening & Joining Reference Issue*, Sept. 11, p. 38
- Schermerhorn, Robert S. and Martin I. Taft
"Minimizing Risk Factors in Design," Jan. 9, p. 120
"Decision-Making With Utility Theory," Feb. 6, p. 122
- Schwartz, N. J. and N. E. Taylor—"Circuit Breakers," *Electric Controls Reference Issue*, Mar. 13, p. 81
- Schwarzopf, D.—"Precision Snap-Acting Switches," *Electric Controls Reference Issue*, Mar. 13, p. 12
- Seitz, William A. and Stephen Petrus
"Single-Thread Engaging Nuts," *Fastening & Joining Reference Issue*, Sept. 11, p. 48
"Caged Nuts," *Fastening & Joining Reference Issue*, Sept. 11, p. 53
"Spring Clips," *Fastening & Joining Reference Issue*, Sept. 11, p. 84
- Shalkey, A. T., R. G. Bayer and A. R. Wayson—"Zero Wear," Jan. 9, p. 142
- Sharpe, Louis H.—"Adhesive Bonding," *Fastening & Joining Reference Issue*, Sept. 11, p. 119
- Shepler, Paul R.—"Split-Ring Seals," *Seals Reference Issue*, June 19, p. 16
- Singleton, Robert C.—"Arc-Welded Fasteners," *Fastening & Joining Reference Issue*, Sept. 11, p. 41
- Smith, Jerome F. and David M. Borcina—"Soldering and Soldering Alloys," *Fastening & Joining Reference Issue*, Sept. 11, p. 116
- Smoley, Earl M.
"Joint and Gasket Design," *Seals Reference Issue*, June 19, p. 61
"Gasket Materials and Forms," *Seals Reference Issue*, June 19, p. 67
- Spector, Leo
"Before It's Too Late, Denovate," Apr. 3, p. 20
"The Self-Cleaning Oven Derby," Apr. 17, p. 47
"The Entertaining Scoreboard," July 24, p. 39
"Photo Enlargements in a Minute," Sept. 18, p. 14
"Guidance System for Innovation," Sept. 18, p. 26
"Living With Runaway Technology," Sept. 18, p. 190
"Feeding People On The Go," Oct. 2, p. 20
"Hobbies for Engineers: Radio-Control Models," Nov. 13, p. 20
"Supertrap for Invisible Particles," Dec. 11, p. 40
"Think Games," Dec. 25, p. 28
- Sprow, Eugene—"Liquid Crystals—A Film In Your Future," Feb. 6, p. 34
- Stein, H. L.—"Sealants," *Seals Reference Issue*, June 19, p. 85
- Stevens, Justus B.—"Metal-Bellows Types," *Seals Reference Issue*, June 19, p. 32
- Steward, John H.—"Self-Piercing Nuts," *Fastening & Joining Reference Issue*, Sept. 11, p. 56
- Still, Jack H.—"Pulse Technology," Apr. 17, p. 246
- Strauss, Paul S.—"What's Your Job Satisfaction Quotient?" May 29, p. 97
- Strauss, Paul S. and Jack Carlock—"Common Sense Needs an Assist," July 24, p. 102
- Swieskowski, Henry—"Rectangular-Wire Spring Design," Aug. 21, p. 125

T

- Taft, Martin I. and Robert S. Schermerhorn
"Minimizing Risk Factors in Design," Jan. 9, p. 120
"Decision-Making With Utility Theory," Feb. 6, p. 122
- Tankus, Harry—"General Types," *Seals Reference Issue*, June 19, p. 24
- Taschenberg, Ernest—"Circumferential Seals," *Seals Reference Issue*, June 19, p. 21
- Taylor, N. E. and N. J. Schwartz—"Circuit Breakers," *Electric Controls Reference Issue*, Mar. 13, p. 81
- Taylor, O. L.—"How To Move Up Without Dropping Out," Oct. 2, p. 98
- Tribus, Myron—"Revolution in Engineering Education," Sept. 18, p. 215
- Tustin, Wayne—"Vibration Testing"
Part 1: "Instrument Selection," May 29, p. 116
Part 2: "Analysis of Complex Vibrations," June 12, p. 195
Part 3: "Avoiding Vibration Damage," June 26, p. 140
- Tyson, Samuel E.—"Simplifying The Selection of Stainless Steels," Oct. 2, p. 139

V

- Viscio, Donald P.—"Inserts," *Fastening & Joining Reference Issue*, Sept. 11, p. 59

W

- Wadlington, R. P.—"Packaged Adjustable-Speed Drives," *Mechanical Drives Reference Issue*, Dec. 18, p. 25
- Wagner, D. P. and T. P. Hurst—"Washers," *Fastening & Joining Reference Issue*, Sept. 11, p. 63
- Wallenhorst, R. G.—"Component Status Chart," Nov. 27, p. 111
- Wayson, A. R. and R. G. Bayer—"Designing for Measurable Wear," Aug. 7, p. 118
- Wayson, A. R., R. G. Bayer and A. T. Shalkey—"Zero Wear," Jan. 9, p. 142
- Webb, John—"Hollow Castings," Mar. 6, p. 130
- Weeton, John W.—"Fiber-Metal Matrix Composites," Feb. 20, p. 141
- Weinstein, Warren D.—"Microporosity of Metals," Dec. 11, p. 174
- White, H. A. and O. V. Gigliotti—"Magnetization of Permanent Magnets," July 24, p. 128
- White, Kenneth L.—"Precipitation-Hardening Stainless Steels," Jan. 23, p. 142
- White, Lloyd A.—"Meeting Methodology," June 12, p. 161
- Wilkinson, D. H.—"Radial Lip Seals," *Seals Reference Issue*, June 19, p. 5
- Wirry, Henry J.—"Torque Converters," *Mechanical Drives Reference Issue*, Dec. 18, p. 34
- Wise, Clare E. and Nat F. Wood—"Andy at Indy," May 15, p. 20
- Wise, Clare E.
 "Assault On the Sea," Apr. 17, p. 20
 "The Urban Mobility Hang-Up," Apr. 17, p. 36
 "Trip Guide To Apollo 10," May 15, p. 36
 "Design For Repairability," June 26, p. 20
 "Elation, Apprehension Str Scientific Community on Eve of Apollo 11," July 10, p. 36
 "Twin Mariners Nearing Mars," July 24, p. 20
 "Product Safety," Aug. 7, p. 19
 "Lunar Experiments Promise Rich Return," Aug. 21, p. 31
 "Stripes, Scoops, and Spoilers—Signs of The Swinging '70s," Sept. 4, p. 20
- Wolosewicz, Dr. Ronald and T. E. Aaron—"Electrochemical Machining," Dec. 11, p. 160
- Wood, Nat F. and Robert Aronson—"Nerva—Key to Deep Space Flight," July 24, p. 24

- Wood, Nat F. and Clare E. Wise—"Andy at Indy," May 15, p. 20
- Wood, Nat F.
 "Piggyback Models Mimic Spacecraft," Jan. 9, p. 40
 "Weather," Mar. 6, p. 19
 "The Questionable Art of Alteration," Mar. 20, p. 33
 "Controlling Air Traffic—1: Crisis in Crowded Skies," May 1, p. 20
 "Steam," June 12, p. 20
 "The Automated Sky," Oct. 30, p. 19
 "X-15: Black Bullet that Paved a Path to the Moon," Nov. 27, p. 30
 "The Next Big Step: Stations in Space," Dec. 25, p. 20
- Wright, D. V. and R. L. Bannister—"Prognosis with Plastic Models" Part 1: "Vibration and Deflection Study," Aug. 21, p. 134
 Part 2: "Sealing and Fabrication," Sept. 4, p. 136
 Part 3: "Instrumentation for Dynamic Testing," Oct. 2, p. 128
 Part 4: "Material Properties and Sample Study," Oct. 16, p. 178
- Wroten, C. D.—"Pneumatic Line Losses," Dec. 11, p. 182
- Wurzel, Hugo—"Retaining Rings," *Fastening & Joining Reference Issue*, Sept. 11, p. 90

Y

- Young, William C. and Donald L. Kirkpatrick—"Dry-Lubricant Films," May 15, p. 163

Z

- Zaiss, Joseph J.—"Flat Belts," *Mechanical Drives Reference Issue*, Dec. 18, p. 15
- Zambetti, Frank—"Flexible Shafts," *Mechanical Drives Reference Issue*, Dec. 18, p. 70
- Zawacki, Stanley T.—"Making Meetings Count," Jan. 23, p. 130
- Zimmerman, Mark D.
 "Army Aims for Commonality: Universal Power Units," Nov. 13, p. 52
 "Escape Machines for all Seasons: ATVs," Dec. 11, p. 20

SUBJECT INDEX

Numbers preceding the column heads refer to the MACHINE DESIGN Subject Classification Systems (January 1970).

Editorial material in this section is classified according to the following system:

- | 1 | 2 | 3 | 4 | 5 |
|--|--------------------------------|-----|-----|-------|
| Sensing Suddenness | Kear | 8/7 | 132 | (4.0) |
| 1. Title. | | | | |
| 2. Author's last name (see Author Index for complete name). Departments in regular issues are denoted by the following code: | | | | |
| N/T | News/Trends | | | |
| Scan | Scanning the Field for Ideas | | | |
| DIA | Design in Action | | | |
| DI | Design International | | | |
| CD | Conference Digest | | | |
| AD | Abstracts for Design | | | |
| 3. Date of issue, MACHINE DESIGN Reference Issues are denoted by the following code: | | | | |
| EC | Electric Controls (March 13) | | | |
| S | Seals (June 19) | | | |
| F&J | Fastening & Joining (Sept. 11) | | | |
| MD | Mechanical Drives (Dec. 18) | | | |
| 4. Page Number. | | | | |
| 5. Number of pages in article or editorial item. | | | | |

Electrical and Electronic Drives, Controls and Systems

11. Electric Motors

| | | | | |
|--|------------|-------|-----|-------|
| The Family Tree of Electric Motors..... | Collins | 1/9 | 152 | (5.0) |
| Controlling Brushless D-C Motors..... | Lujtle | 10/30 | 113 | (3.0) |
| The Polyphase Variable-Speed Commutator Motor..... | Dreisilker | 7/10 | 130 | (7.0) |
| Linear Motors Rotor-Lined Conveyor..... | DI | 11/13 | 57 | (0.5) |

12. Power Supplies

| | | | | |
|---|---------|-------|-----|-------|
| Hybrid Power System Promises Less Air Pollution..... | Article | 12/11 | 18 | (1.0) |
| Electric Cart Sheds Pounds of Batteries..... | Scan | 2/6 | 14 | (0.5) |
| Battery-Pressure Monitor Speeds Charging..... | Scan | 9/4 | 117 | (0.5) |
| 30-Year Life Predicted for Lead-Acid Battery..... | N/T | 10/2 | 10 | (0.5) |
| Light Beam Rotation Couples Transformer Windings..... | Scan | 5/15 | 148 | (1.0) |
| Oxygen Maker Not Winded After 11-Month "Sprint"..... | N/T | 12/11 | 48 | (0.5) |

13. Switches and Relays

| | | | | |
|--|-------------------|---------|-----|-------|
| Service-Generator Circuit Protects Jet Wiring..... | Scan | 4/17 | 261 | (1.0) |
| Manual Switches..... | Bassett & Burt | EC 3/13 | 4 | (8.0) |
| Mercury-Wetted Contact Relays..... | Koda | EC 3/13 | 40 | (2.4) |
| Applying Snap-Acting Switches..... | Lockwood | 10/2 | 122 | (6.0) |
| Timing Switch Adjusts While Running..... | Scan | 4/17 | 262 | (1.0) |
| Spring Tape Commutates Binary-Code Miniswitch..... | Scan | 12/11 | 158 | (0.5) |
| Temperature Switches..... | Howard | EC 3/13 | 31 | (4.0) |
| Pressure Switches..... | Ruffer | EC 3/13 | 25 | (5.5) |
| Precision Snap-Acting Switches..... | Schwarzkopf | EC 3/13 | 12 | (5.4) |
| Limit Switches..... | Farrow | EC 3/13 | 17 | (4.3) |
| Proximity Switches..... | Leonard | EC 3/13 | 21 | (3.8) |
| Fastest Light Switch Will Speed Up Computers..... | N/T | 5/1 | 31 | (0.8) |
| Pneumo-Mechanical Memory Sparkproofs..... | Scan | 8/21 | 113 | (0.6) |
| Spraying Stepping Switches..... | Dibbern & James | EC 3/13 | 47 | (3.0) |
| Electromechanical or Solid State?..... | Belting | 6/24 | 122 | (2.0) |
| Armature Relays..... | Foster & Probert | EC 3/13 | 44 | (3.0) |
| Circuit Breakers..... | Schwartz & Taylor | EC 3/13 | 81 | (4.0) |
| Sensing Suddenness..... | Kear | 8/7 | 132 | (4.0) |
| Reed Relays..... | Rosenberg | EC 3/13 | 38 | (2.6) |
| Diaphragm Relay Challenges Reed-Switch Rival..... | Scan | 10/16 | 154 | (0.5) |

14. Instruments and Controls

| | | | | |
|--|-------------------|---------|-----|--------|
| Trends in Electric Controls..... | Leonard | EC 3/13 | 3 | (1.0) |
| Instrumentation Improvers Look to Superconductivity..... | N/T | 10/16 | 14 | (0.5) |
| Technical Codes: The Language of Machines..... | Bickford | 9/4 | 108 | (7.0) |
| Resistance Thermometers..... | Hornmuth | 7/10 | 136 | (4.0) |
| Thermocouple Pyrometry..... | Hornmuth | 8/21 | 129 | (6.0) |
| Measuring Temperature..... | Lynnworth & Benes | 11/13 | 190 | (15.0) |
| Sensing System Predicts Bridge Icing..... | Scan | 3/20 | 211 | (1.0) |
| X-Rays Sift Diamonds From Gravel Mixture..... | Scan | 8/7 | 112 | (0.5) |
| Heat-Shield Thermocouple Monitors as it Melts..... | Scan | 12/11 | 155 | (0.5) |
| Noncontact Temperature Measurements..... | CD | 6/26 | 144 | (1.7) |
| NEMA Control Relays..... | Russo | EC 3/13 | 50 | (4.0) |
| Contactors..... | Russo | EC 3/13 | 85 | (2.0) |
| Pulse Operation of Solenoids..... | Allen | 5/1 | 170 | (4.0) |
| Timers..... | Bonneau | EC 3/13 | 59 | (5.0) |
| Counters..... | Bonneau | EC 3/13 | 59 | (5.0) |
| Signature Analysis—Product Early-Warning System..... | Lavole | 1/23 | 151 | (11.0) |
| High-Resolution Readouts..... | Karas | 6/26 | 133 | (7.0) |
| High-Fidelity Testing..... | Khol | 6/26 | 107 | (6.0) |
| Mobile Printer Cured of Noise-Induced "Acne"..... | Scan | 11/13 | 186 | (0.7) |
| The Entertaining Scoreboard..... | Spector | 6/24 | 39 | (3.0) |
| Wire Forest Freezes 3-D Plot..... | Scan | 4/3 | 134 | (1.0) |
| Servo Control Stretches Readout Scale..... | Scan | 5/29 | 111 | (0.6) |
| Twisting Jet Tube Forms Low-Inertia Recorder Pen..... | Scan | 12/11 | 156 | (0.5) |
| Baby Breath Monitor..... | DI | 11/13 | 56 | (0.5) |
| Thin Rotor Perks up Servomotor Startup..... | Scan | 10/16 | 152 | (0.5) |
| Four Extra Rotors Improve Stepper-Motor Act..... | Scan | 4/17 | 258 | (1.0) |

15, 16. Circuit Components, Connectors and Wiring

| | | | | |
|---|-----------------------|---------|-----|--------|
| Pulse Technology..... | Still | 4/17 | 246 | (12.0) |
| Squeezed Tape Monitors Level or Position..... | Scan | 8/21 | 115 | (0.6) |
| Solid-State Relays..... | Metzler | EC 3/13 | 35 | (3.0) |
| Electromechanical or Solid State?..... | Belting | 6/24 | 122 | (2.0) |
| Basic Course in Integrated Circuits: | | | | |
| Lesson 7: Characteristics of Digital ICs..... | Hibberd | 1/9 | 157 | (4.0) |
| Lesson 8: Families of Digital ICs..... | Hibberd | 1/23 | 163 | (8.0) |
| Lesson 9: Elements of Linear ICs..... | Hibberd | 2/6 | 153 | (6.0) |
| Lesson 10: Basic Types of Linear ICs..... | Hibberd | 2/20 | 169 | (6.0) |
| Lesson 11: Standard Digital ICs..... | Hibberd | 3/6 | 149 | (9.0) |
| Lesson 12: Standard MOS and Linear ICs..... | Hibberd | 3/20 | 215 | (5.0) |
| Lesson 13: Integrated Electronic Circuits..... | Hibberd | 4/3 | 155 | (7.0) |
| Lesson 14: IC Applications, Present and Future..... | Hibberd | 4/17 | 263 | (7.0) |
| Lesson 15: ICs in Industrial Control..... | Hibberd | 5/1 | 187 | (7.0) |
| Switching Transistors..... | Jalbert | EC 3/13 | 64 | (3.0) |
| Thyristors..... | Rice | EC 3/13 | 67 | (4.0) |
| Digital Integrated Circuits..... | Crews | EC 3/13 | 71 | (6.2) |
| Packaged Discrete Modules..... | Doane | EC 3/13 | 77 | (3.8) |
| Beyond Integrated Circuits..... | Lavole | 3/20 | 181 | (6.0) |
| Applying Power Logic-Triacs..... | Parrish | 4/3 | 149 | (6.0) |
| All Circuit Components Fitted Into "Zero" Space..... | N/T | 10/2 | 18 | (1.0) |
| Iris Mask, HT Glass Brightens Color TV..... | N/T | 7/10 | 10 | (0.6) |
| Laser Provides New Data on Impact..... | Lavole | 3/20 | 212 | (3.0) |
| Using Lasers For Dynamic Measurements..... | CD | 11/13 | 228 | (2.0) |
| Picking The Right Connector..... | Corrigan & Elchenseer | 2/20 | 162 | (5.0) |
| Designing Printed Wiring Boards..... | Cavasin | 1/23 | 133 | (6.0) |
| Computer Matches Designer, Methods Man As Working Team..... | Khol | 3/6 | 127 | (3.0) |
| Picking a Power Cord..... | Prifogle | 12/11 | 168 | (6.0) |
| Buried A-C Superconductor..... | N/T | 6/24 | 31 | (2.0) |
| Documenting Printed-Wiring Packages..... | Jacobs | 5/15 | 166 | (8.0) |

17. General Components

| | | | | |
|---|-------------------|----------|-----|-------|
| Mechanical Design of Permanent Magnets..... | Loucks | 6/24 | 124 | (4.0) |
| Magnetization of Permanent Magnets..... | White & Gigliotti | 6/24 | 128 | (4.0) |
| Electrostatic Forces Called on to Solve Space Problems..... | N/T | 12/11 | 10 | (0.5) |
| Subminiature Lamps..... | Curran | 11/27 | 134 | (6.0) |
| Light From Explosion Separated From Blast..... | N/T | 2/6 | 12 | (0.5) |
| Sculptured Headlight Beam Dodges Oncoming Traffic..... | Scan | 1/23 | 141 | (1.0) |
| Spacecraft to Get Indestructible Heat Source..... | N/T | 12/11 | 14 | (0.5) |
| Avoiding Cold Spots Along the Wall of a Vat..... | Scan | 6/26 | 132 | (0.5) |
| A Toast To A Toaster Toaster..... | Scan | 5/15 | 153 | (1.0) |
| Magnetic Couplings..... | Gaster | 4/3 | 147 | (2.0) |
| Brakes: Electric Brakes..... | Lavole | MD 12/18 | 57 | (2.3) |
| Clutches: Electric Clutches..... | Pech | MD 12/18 | 47 | (4.3) |

19. Systems, Drives, Assemblies

| | | | | |
|--|-----------|-------|-----|--------|
| Adaptive Control Toward The Thinking Machine..... | Khol | 5/1 | 156 | (14.0) |
| Controlling Brushless D-C Motors..... | Lujtle | 10/30 | 113 | (3.0) |
| Radio-Control Models..... | Spector | 11/13 | 20 | (8.0) |
| Crisis In Crowded Skies: Part I—Controlling Air Traffic..... | Wood | 5/1 | 20 | (7.0) |
| The Automated Sky..... | Wood | 10/30 | 19 | (9.0) |
| Parentheses Propel Platform..... | N/T | 10/30 | 34 | (1.0) |
| Complex Circuitry Tested in Seconds..... | N/T | 11/27 | 18 | (0.6) |
| Self-Test Circuit Monitors Recorder Operation..... | Scan | 5/1 | 181 | (0.5) |
| Take-Home Computer Terminals..... | Klein | 10/16 | 52 | (4.0) |
| Time-Sharing Goes Analog..... | Lavole | 4/3 | 131 | (3.0) |
| Computers: 1969-1980..... | Lavole | 10/2 | 106 | (11.0) |
| Used Computers: Big-Time Data Processing at Bargain-Basement Prices..... | Lavole | 11/27 | 114 | (6.0) |
| Minicomputers..... | Lavole | 12/25 | 54 | (7.0) |
| Quickly and Continuously Drawing Converted To Tape..... | N/T | 8/7 | 44 | (0.6) |
| Machines Are Learning To Learn By Experience..... | N/T | 11/13 | 18 | (0.5) |
| Computer On The Counter..... | (Article) | 5/1 | 32 | (2.0) |
| Programs for Hire..... | Lavole | 5/15 | 132 | (6.0) |
| Self-Healing Computer Readied for Space..... | N/T | 10/2 | 12 | (0.7) |
| Electric Eyes Monitor Tape Wander..... | Scan | 1/9 | 132 | (1.0) |

Fluid Drives, Controls and Systems

21, 22. Fluids, Fluid Conditioners

| | | | | |
|--|----------|-------|-----|-------|
| Hydraulic Effects in Fluidics and Piping | CD | 3/20 | 221 | (2.0) |
| Controlling Hydraulic Contamination | CD | 10/30 | 124 | (2.0) |
| The Climate Control Machine | N/T | 2/6 | 42 | (2.0) |
| New Process Promises Clean Water At Low Cost | N/T | 10/30 | 14 | (0.5) |
| Collapsible Tank Provides Key to Oil Pollution Control | N/T | 12/11 | 12 | (0.9) |
| Controlling Hydraulic Contamination | CD | 10/30 | 124 | (2.0) |
| Hydraulic System Design | Kauffman | 10/30 | 116 | (5.0) |
| Cooling Enclosed Electronics | Hay | 3/6 | 140 | (4.0) |

24. Linear Devices

| | | | | |
|---|---------|-------|-----|-------|
| Synchronizing Hydraulic Cylinders | Metzger | 8/21 | 141 | (4.0) |
| Sequencing Hydraulic Cylinders | Metzger | 11/13 | 218 | (4.0) |
| Simple Pump Moves Human Blood | N/T | 12/25 | 14 | (0.6) |
| Side-Stepping Bellows Shuffle Heavy Loads | Scan | 8/21 | 111 | (1.0) |
| Punch Puller Pierces Panel Ports | Scan | 5/29 | 113 | (1.0) |
| Coanda Effect Moves Out to Sea | Scan | 10/30 | 107 | (0.6) |

25. Rotary Devices

| | | | | |
|--|------|------|-----|-------|
| Spacer Ring Freezes Pump-Vane Clearances | Scan | 3/6 | 145 | (0.6) |
| Drinking Water Pumped Over Mountains | N/T | 5/15 | 42 | (0.7) |
| Powered Hinge Battens the Hatches | Scan | 2/6 | 131 | (1.0) |

26. Seals, Packings, Gaskets

| | | | | |
|---|----------------------|--------|----|--------|
| Trends in Sealing | Dega | 8/6/19 | 3 | (2.0) |
| Diaphragm Seals | North & Quimby | 8/6/19 | 56 | (5.0) |
| Exclusion Devices | Jaenbarger | 8/6/19 | 11 | (3.0) |
| Radial Lip Seals | Wilkinson | 8/6/19 | 5 | (5.0) |
| Ring Seals: Split-Ring Seals | Shepler | 8/6/19 | 16 | (7.7) |
| Ring Seals: Circumferential Seals | Taschenberg | 8/6/19 | 21 | (7.7) |
| Clearance Seals | Kuchler | 8/6/19 | 13 | (3.0) |
| Face Seals: Metal-Bellows Types | Stevens | 8/6/19 | 32 | (11.0) |
| Face Seals: General Types | Tankus | 8/6/19 | 24 | (11.0) |
| Metallic Gaskets: General Types | Dunkle | 8/6/19 | 76 | (0.0) |
| Metallic Gaskets: O-Ring Types | Gastineau & Gillette | 8/6/19 | 83 | (0.0) |
| Nonmetallic Gaskets: Elastomeric O-Rings | Everett | 8/6/19 | 73 | (15.0) |
| Nonmetallic Gaskets: Gasket Materials and Forms | Smoley | 8/6/19 | 67 | (15.0) |
| Nonmetallic Gaskets: Joint and Gasket Design | Smoley | 8/6/19 | 61 | (15.0) |

Compression Packings

| | | | | |
|------------------------------------|--------------------|--------|----|--------|
| Molded Packings: Lip Types | Mathews & McKillop | 8/6/19 | 35 | (5.0) |
| Molded Packings: Felt Radial Types | Boyce | 8/6/19 | 40 | (16.0) |
| Molded Packings: Squeeze Types | Chapter | 8/6/19 | 54 | (16.0) |
| | Gillette & Everett | 8/6/19 | 47 | (16.0) |

27. Valves

| | | | | |
|---|-----------|-------|-----|-------|
| Bouncing Ball Checks Transmission Leaks | Scan | 3/20 | 208 | (1.0) |
| Eccentric Plug Improves Valve Characteristics | Scan | 4/3 | 136 | (0.5) |
| Fuel Injection Is Ready | (Article) | 10/30 | 36 | (2.7) |

28. Instruments and Controls

| | | | | |
|--|------|-------|-----|-------|
| A-C Fluidics | Khol | 2/6 | 126 | (5.0) |
| Fluidic Gage/Logic System Inspects Parts | Scan | 3/6 | 148 | (1.0) |
| Fluidic Governor Reads Air-Motor Ripple | Scan | 10/16 | 152 | (0.5) |
| Power Diaphragms Double as Poppets | Scan | 11/27 | 130 | (0.6) |
| Video Signal Orients Jet-Set Characters | Scan | 10/2 | 118 | (0.5) |

29. Systems and Assemblies

| | | | | |
|--|----------|----------|-----|-------|
| Analyzing Hydraulic Circuits | Esposito | 10/16 | 173 | (5.0) |
| Hydraulic Or Pneumatic | Metzger | 6/26 | 126 | (4.0) |
| Checking Hydraulic System Performance | Metzger | 2/6 | 134 | (4.0) |
| Hydraulic System Design | Kauffman | 9/4 | 118 | (3.0) |
| Hydraulic System Design | Kauffman | 10/2 | 134 | (5.0) |
| Hydraulic System Design | Kauffman | 10/30 | 116 | (5.0) |
| Hydraulic System Design, Part 4: Machine-Tool Traverse and Feed Circuits | Kauffman | 11/27 | 144 | (6.0) |
| Control of Machine-Tool Feed | Kauffman | 12/25 | 78 | (6.0) |
| Hydraulic System Maintenance | Metzger | 3/20 | 205 | (3.0) |
| Closed-Center Hydraulic Systems | Metzger | 4/17 | 239 | (7.0) |
| Synchronizing Hydraulic Cylinders | Metzger | 8/21 | 141 | (4.0) |
| Sequencing Hydraulic Cylinders | Metzger | 11/13 | 218 | (4.0) |
| Pneumatic Line Losses | Wroten | 12/11 | 182 | (4.0) |
| Hybrid Controls Speed Up Machining | Scan | 3/6 | 146 | (1.0) |
| Puff the Pneumatic Label Sticker | Scan | 8/7 | 113 | (0.7) |
| Gas-Powered Pump Boosts Its Own Pressure | Scan | 8/21 | 114 | (0.6) |
| Cable-Snapping Tongue Pacified by Hydraulics | Scan | 12/25 | 65 | (1.0) |
| Resonant Hydraulics Blow High-Speed Bubbles | Scan | 12/25 | 66 | (1.0) |
| Double-Action Flapper Stops Truck Tipping | Scan | 8/7 | 111 | (1.0) |
| Speed Check Controls Skidless Braking | Scan | 12/11 | 157 | (0.5) |
| Packaged Adjustable-Speed Drives: Torque Converters | Wirry | MD 12/18 | 34 | (3.5) |
| Silo Rescues Oil From Hostile Engine | Scan | 12/11 | 158 | (0.5) |

Mechanical Drives, Controls and Systems

31. Engines, Atomic Power, Power Sources

| | | | | |
|---|-----------|----------|-----|--------|
| Trends in Mechanical Drives | Olson | MD 12/18 | 3 | (2.0) |
| Why Nothing Will Replace The Internal-Combustion Engine | Wine | 5/29 | 39 | (4.4) |
| At Future Indy-500s, Public Will See Nothing New | N/T | 9/18 | 18 | (0.5) |
| Jets Quieted By Noise Absorbing Ducts | N/T | 5/1 | 10 | (0.5) |
| Fuel Injection Is Ready | (Article) | 10/30 | 39 | (2.7) |
| A Rotary Engine That Doesn't Rotate | Scan | 5/1 | 179 | (1.0) |
| Glass-Ceramic Regenerator Impresses Gas-Turbine Designers | N/T | 5/15 | 18 | (0.6) |
| SNAP-8 Reaches Program Goal | N/T | 10/2 | 10 | (0.5) |
| NERVA—Key To Deep Space Flight | Aronson | 6/24 | 24 | (4.0) |
| Taming the Bomb | Klein | 10/16 | 19 | (10.0) |
| Ear-Ring Rocket Will Nudge Big Spacecraft Back On Course | N/T | 10/30 | 14 | (0.6) |
| Smokeless Propellant Sneaks Missile Away | N/T | 10/30 | 40 | (0.5) |
| Utility Will Field Fleet of Gas/Gas Cars | Wood | 2/20 | 31 | (3.0) |
| Has Bill Lear Run Out of Steam? Well Not Exactly | Wise | 12/11 | 34 | (3.0) |
| Steamer Assaults Speed Record | N/T | 11/13 | 14 | (1.3) |

32-34. Drives, Transmissions, Drive Components

| | | | | |
|--|---------|----------|-----|-------|
| Speed Reducers: Shaft-Mounted Reducers | Chung | MD 12/18 | 41 | (1.5) |
| Speed Reducers: Base-Mounted Reducers | Lorvick | MD 12/18 | 38 | (3.2) |
| Dual Bearings Control Turntable Torque | Scan | 11/27 | 132 | (0.7) |

Packaged Adjustable-Speed Drives: Belt and Chain Drives

| | | | | |
|--|-----------------|----------|-----|-------|
| Packaged Adjustable-Speed Drives: Belt and Chain Drives | Malcolm | MD 12/18 | 27 | (3.1) |
| Packaged Adjustable-Speed Drives: Belt and Chain Drives | Malcolm | MD 12/18 | 27 | (3.1) |
| Packaged Adjustable-Speed Drives: Friction and Traction Drives | Burnett | MD 12/18 | 30 | (2.7) |
| Packaged Adjustable-Speed Drives: Gear Drives | Wadlington | MD 12/18 | 25 | (2.4) |
| Torque-Sensing Spring Shifts Transmission | Scan | 4/3 | 137 | (0.6) |
| Packaged Adjustable-Speed Drives: Variable-Stroke Drives | Lavole | MD 12/18 | 33 | (1.0) |
| Roller Chain Ratings | Hofmeister | 5/29 | 125 | (4.0) |
| Chains | Pearce | MD 12/18 | 5 | (4.0) |
| Split-Chain Loader Helps Feed Jumbo V-Belts | Scan | 11/27 | 128 | (1.0) |
| | Nuernberger | MD 12/18 | 9 | (6.0) |
| Flat Belts | Zais | MD 12/18 | 15 | (4.0) |
| Analytically Magnified Gear Tooth Profiles | Breuer | 2/20 | 167 | (2.0) |
| Gears | Crawshaw & Kron | MD 12/18 | 19 | (6.0) |
| Trends in Gearing | Lavole | 8/7 | 104 | (7.0) |
| High-Speed Gearing | Lorvick | 3/20 | 156 | (5.0) |
| Roll-Forming Gears | Lavole | 4/17 | 233 | (6.0) |
| Drive-Train Vibrations | Rieger | 7/10 | 115 | (5.0) |
| Forecasting Gear Failure | CD | 5/15 | 181 | (1.8) |
| Worm Cuts Its Own Gear Teeth | Scan | 6/24 | 117 | (1.0) |
| Chains | Pearce | MD 12/18 | 5 | (4.0) |
| V-Belts | Nuernberger | MD 12/18 | 9 | (6.0) |

35. Rotational Components

| | | | | |
|--|-----------------|-------|-------|----------|
| Bearing-Life Equations Don't Reflect Advances | N/T | 5/15 | 40 | (0.6) |
| Linear Bearing Cuts Prop Slop | Scan | 10/16 | 154 | (0.5) |
| Flat-Pad Thrust Bearings | Elwell & Booser | 9/4 | 141 | (6.0) |
| Fold Bearings | Licht & Eshel | 5/15 | 154 | (9.0) |
| Couplings | Grundtner | | | |
| | MD | 12/18 | 60 | (6.0) |
| Flexible Shafts | Zambetti | | | |
| | MD | 12/18 | 70 | (3.0) |
| Universal Joints | (Chapter) | | | |
| | MD | 12/18 | 66 | (4.0) |
| Fluid Couplings | Lavole | MD | 12/18 | 52 (2.0) |
| Crankshaft/Gear Arrangement Eliminates Connecting-Rod Wobble | Scan | 1/23 | 139 | (1.0) |
| Clutches: Mechanical Clutches | Cozzarin | MD | 12/18 | 43 (4.5) |
| Brakes: Mechanical Brakes | Dombeck | | | |
| | MD | 12/18 | 54 | (3.5) |
| Braking Study Seeks Best Runway | N/T | 10/30 | 44 | (0.7) |

| | | | | |
|--|------|------|-----|-------|
| Braked Pivot Stops Trailer Jackknifing | Scan | 6/26 | 130 | (1.0) |
| Spring Combination Renders Clutch Torque-Sensitive | Scan | 1/9 | 131 | (1.0) |
| Toggle Mechanism Monitors Clutch Torque | Scan | 2/6 | 133 | (0.5) |
| Nuclearly Ionized Air Blows Away Static | Scan | 10/2 | 120 | (0.7) |

36. Mechanisms

| | | | | |
|--|------|-------|-----|-------|
| "Custom-Designed" Cams Realign Crooked Type | Scan | 10/16 | 155 | (0.5) |
| Nonlinear Cam Tailors Controller Gain | Scan | 10/30 | 104 | (1.0) |
| Cable-Snapping Tongs Pacified by Hydraulics | Scan | 12/25 | 65 | (1.0) |
| Tapered Ribs and Captive Rollers Wipe Out Backlash | Scan | 10/30 | 106 | (0.5) |
| Wire is the Medium, Weights are the Message | Scan | 11/13 | 181 | (1.0) |
| Air-Liquid Transfer Arms Booby Trap | Scan | 11/13 | 188 | (0.5) |

Assembly Components

41. Fasteners

| | | | | |
|--|----------------|------|------|-----------|
| How Fasteners Are Made | Baumgartner | 1/9 | 136 | (6.0) |
| High-Performance Bolt Materials | Osgood | 5/1 | 184 | (3.0) |
| Trends in Fastening and Joining | (Chapter) | | | |
| | F&J | 9/11 | 3 | (1.0) |
| Inserts | Vlacio | F&J | 9/11 | 59 (4.0) |
| Captive or Self-Retaining Nuts: Anchor Nuts | Mihaly | F&J | 9/11 | 51 (7.8) |
| Captive or Self-Retaining Nuts: Caged Nuts | Seltz & Petrus | F&J | 9/11 | 53 (7.8) |
| Captive or Self-Retaining Nuts: Clinch Nuts | Massey | F&J | 9/11 | 54 (7.8) |
| Captive or Self-Retaining Nuts: Self-Piercing Nuts | Steward | F&J | 9/11 | 56 (7.8) |
| Single-Thread Engaging Nuts | Seltz & Petrus | F&J | 9/11 | 48 (3.0) |
| Pin Fasteners | Braendel | F&J | 9/11 | 70 (4.8) |
| Double Nut Fights Structural Fatigue | Scan | 5/15 | 152 | (0.6) |
| Quick-Operating Fasteners | Barry | F&J | 9/11 | 101 (3.0) |
| Retaining Rings: Stamped Retaining Rings | (Chapter) | | | |
| | F&J | 9/11 | 90 | (6.0) |
| Retaining Rings: Wire-Formed Retaining Rings | Miller | F&J | 9/11 | 93 (6.0) |
| Spiral-Wound Retaining Rings | McCormick | F&J | 9/11 | 96 (4.6) |
| Flush Fastener Fights Fatigue Failure | Scan | 5/1 | 183 | (0.7) |
| Blind Rivets | (Chapter) | | | |
| | F&J | 9/11 | 81 | (3.0) |
| Small Rivets | (Chapter) | | | |
| | F&J | 9/11 | 75 | (5.6) |
| Setscrews | Kull | F&J | 9/11 | 32 (4.0) |

| | | | | |
|---------------------------------|----------------|-------|------|----------|
| Studs | (Chapter) | | | |
| | F&J | 9/11 | 36 | (2.0) |
| Tapping Screws | (Chapter) | | | |
| | F&J | 9/11 | 27 | (5.0) |
| Dead Thread Comes Back to Haunt | Scan | 12/11 | 155 | (0.5) |
| Lockwasher | Hurst & Wagner | F&J | 9/11 | 63 (3.0) |
| Washers | Goldberg | 4/3 | 138 | (4.0) |
| V-Band Couplings | (Chapter) | | | |
| | F&J | 9/11 | 44 | (4.0) |
| Locking Fasteners | Seltz & Petrus | F&J | 9/11 | 84 (6.0) |
| Spring Clips | (Chapter) | | | |
| | F&J | 9/11 | 66 | (3.8) |
| Sealing Fasteners | (Chapter) | | | |
| | F&J | 9/11 | 66 | (3.8) |

42, 43. Springs & Isolation Devices, Misc.

| | | | | |
|---|-------------|-------|-----|-------|
| Designing Torsion Springs | Blandino | 3/6 | 134 | (6.0) |
| Flexing Fingers Pluck Curly Cards | Scan | 8/21 | 112 | (0.6) |
| Pneumatic Barge Coupling Tames Wave Effects | Scan | 3/20 | 209 | (0.6) |
| Bounce Chamber Levels Hydraulic-Shock Peaks | Scan | 6/24 | 120 | (0.7) |
| Bumper Banks on Torsion-Bar Deformation | Scan | 7/10 | 120 | (0.7) |
| Equalized Deflections Tune Shock-Mounted Panels | Scan | 7/10 | 121 | (1.0) |
| Rectangular-Wire Spring Design | Swieskowski | 8/21 | 125 | (3.0) |
| Flip-Flop Requires Alternate Keys | Scan | 11/13 | 185 | (0.5) |
| Matching Flats Trip Rocking Lock | Scan | 11/27 | 129 | (0.6) |
| Bowed Roll Twins Separate Slit Web | Scan | 2/6 | 133 | (0.5) |
| Golf-Cart Meter Calls Your Shots | Scan | 7/10 | 124 | (0.7) |

Materials

51, 52. Ferrous, Nonferrous Metals

| | | | | |
|---|-----------|-------|------|---------|
| Materials | (Chapter) | | | |
| Precipitation-Hardening Stainless Steels | White | F&J | 9/11 | 4 (4.8) |
| Formability of Stainless Steels | Kopecki | 1/23 | 142 | (8.0) |
| Simplifying the Selection of Stainless Steels | Tyson | 2/6 | 149 | (4.0) |
| Trim Protects Car From Rust | N/T | 10/2 | 139 | (3.0) |
| Ultrasonic Testing of High-Strength Alloys | CD | 11/13 | 18 | (0.5) |
| Parts From Aluminum Powder | Khol | 3/6 | 164 | (2.5) |
| Copper Beats Out Steel in Saturn Injector | Khol | 7/10 | 110 | (5.0) |
| Designing With Titanium | Scan | 6/24 | 121 | (0.8) |
| Hard Chromium | Hart | 12/11 | 190 | (1.5) |
| | | 5/15 | 144 | (4.0) |

53, 54. Plastics, Rubber & Elastomer

| | | | | |
|--|--------|-------|-----|-------|
| Structural Behavior of Plastics | CD | 7/10 | 152 | (2.4) |
| Fortified Thermoplastics | Jones | 11/13 | 205 | (3.0) |
| What's Ahead for Stamped Plastics | Lavole | 12/11 | 149 | (5.0) |
| Mechanical Applications For Filled TFE | CD | 1/9 | 162 | (2.0) |
| New Developments in Contact Bearings | CD | 6/24 | 134 | (2.3) |
| Plastic Carb Keeps Its Cool | Scan | 6/24 | 118 | (0.7) |
| Mechanical Applications for Filled TFE | CD | 1/9 | 162 | (2.0) |
| Conductive Plastics | Lilant | 10/16 | 168 | (5.0) |

55, 56. Joining Materials, Other Nonmetals

| | | | | |
|---------------------------------------|-----------------|--------|------|-----------|
| High-Temperature Structural Adhesives | Petrie | 5/15 | 175 | (5.0) |
| Adhesive Bonding | Sharpe | F&J | 9/11 | 119 (9.8) |
| Sealants | Stein | 8/6/19 | 85 | (10.0) |
| Welding and Welding Alloys | Rudy | F&J | 9/11 | 104 (6.8) |
| Brazing and Brazing Alloys | Pattee | F&J | 9/11 | 111 (4.6) |
| Soldering and Soldering Alloys | Smith & Borcina | | | |
| | F&J | 9/11 | 116 | (3.0) |
| Fluorine Doesn't Bother Glassy Carbon | N/T | 12/25 | 12 | (0.5) |

| | | | | |
|--|--------|------|-----|--------|
| For Boeing's 747: 7-Ply Windshield 2 in. Thick | N/T | 4/17 | 14 | (0.5) |
| Designing With Felt | Becker | 6/26 | 113 | (13.0) |
| Polywater: It Freezes At -40 C, Boils At 500 | N/T | 8/7 | 14 | (0.5) |

57. Finishes, Coatings, Lubricants

| | | | | |
|--------------------------------------|----------------------------|-------|-----|-------|
| Finishes and Coatings | (Chapter) | | | |
| | F&J | 9/11 | 9 | (3.0) |
| 'Umbrella' Found For Supersonic Rain | N/T | 9/18 | 34 | (0.5) |
| Vinyl Dispersion Coatings | Palkie | 8/7 | 115 | (3.0) |
| Flip-Flop Requires Alternate Keys | N/T | 2/20 | 40 | (2.0) |
| Nonspray Plastic Coatings | CD | 2/6 | 160 | (2.0) |
| Synthetic Lubricants | Fairbanks, Knapp & Lazarus | 7/10 | 140 | (9.0) |
| Dry-Lubricant Films | Kirkpatrick & Young | 5/15 | 163 | (3.0) |
| Bonding Dry-Film Lubricants | Paulus | 12/25 | 68 | (6.0) |
| Accelerating Lubricants Tests | CD | 10/16 | 188 | (2.2) |
| Sputtering Solid Lubricants | CD | 12/25 | 86 | (1.0) |

58. Prefabricated Forms

| | | | | |
|--|-----------|-------|-----|--------|
| Fiber-Metal Matrix Composites | Weeton | 2/20 | 141 | (16.0) |
| The Composite Aircraft | N/T | 9/4 | 18 | (1.0) |
| Joining Fiber-Reinforced Composites | CD | 5/1 | 194 | (2.4) |
| Composite Material Beef up Chopper Blade | Scan | 8/7 | 112 | (0.5) |
| Joining Metal Tubing | (Article) | 12/25 | 61 | (4.0) |
| Jack-in-the-Box Mast Snaps Into Shape | Scan | 12/11 | 154 | (1.0) |

Manufacturing Methods and Processes

61-63. Metals Casting, Shaping, Forming

| | | | | |
|---|---------|-------|-----|-------|
| Hollow Castings | Webb | 3/6 | 130 | (4.0) |
| Designing With Titanium | CD | 12/11 | 190 | (1.5) |
| Plastic Moldings—Or Metal Die Castings? | Dreger | 6/24 | 113 | (4.0) |
| "Machined Forgings" Produced by New Metal-Forming Process | N/T | 10/30 | 10 | (0.7) |
| 165-mm Projectile Cold Extruded from Steel Disc | N/T | 9/18 | 18 | (0.5) |
| Forged Powder Metal | Khol | 4/3 | 142 | (5.0) |
| Precision Controls Developed for F/M Parts | N/T | 11/13 | 34 | (0.7) |
| High Pressure Forming | Khol | 1/9 | 124 | (7.0) |
| Formability of Stainless Steels | Kopecki | 2/6 | 149 | (4.0) |
| Panel Joiner Zips Up Metal Roof Tin-Can Tight | Scan | 5/29 | 110 | (1.0) |
| What's Ahead for Stamped Plastic | Lavoie | 12/11 | 149 | (5.0) |

64-66. Metals Joining, Removal, Treating

| | | | | | |
|--|-----------|------|-------|-------|-------|
| Welding and Welding Alloys | Rudy | F&J | 9/11 | 104 | (6.8) |
| Joining Metal Tubing | (Article) | | 12/25 | 61 | (4.0) |
| Trends in Fastening and Joining | Chapter | F&J | 9/11 | 3 | (1.0) |
| Specifying Welding Electrodes | Reld | | 2/6 | 146 | (3.0) |
| Assembly-Line Shipyard Builds Warships Upside Down | N/T | | 4/3 | 12 | (0.6) |
| Arc-Welded Fasteners | Singleton | | | | |
| | F&J | 9/11 | 41 | (3.0) | |
| Resistance-Welded Fasteners | Schaft | F&J | 9/11 | 35 | (2.8) |

67-69. Metals Finishing, Plastics Processes

| | | | | | |
|---|---------------------|-------|------|-------|-------|
| Laser Welding | Lavoie | 2/20 | 136 | (5.0) | |
| Explosive Welding | Lavoie | 7/10 | 125 | (5.0) | |
| Brazing Technique Solves Aluminum-Radiator Problems | N/T | 2/6 | 12 | (0.5) | |
| Brazing and Brazing Alloys | Pattee | F&J | 9/11 | 111 | (4.6) |
| Soldering and Soldering Alloys | Smith & Boreina | | | | |
| | F&J | 9/11 | 116 | (3.0) | |
| Bonding Dry-Film Lubricants | Paulus | 12/25 | 88 | (6.0) | |
| Adhesive Bonding | Sharpe | F&J | 9/11 | 119 | (9.8) |
| Fastening Plastics to Nonplastics | CD | 4/17 | 308 | (2.6) | |
| Multidirectional Drill Motion Cuts Machining Time | Scan | 5/15 | 151 | (0.8) | |
| Wire-Screen Grinder Machine "Anything" | N/T | 11/27 | 12 | (0.5) | |
| Electrochemical Machining | Aaron & Woloszewicz | 12/11 | 160 | (8.0) | |
| Flexibility Added to Electrochemical Machining | N/T | 11/13 | 10 | (0.5) | |

Design Theory and Techniques

71-73. Mechanics, Strength of Materials and Parts

| | | | | |
|--|-------------------------|-------|-----|--------|
| International Mechanisms Group Established | N/T | 10/30 | 42 | (0.7) |
| Practical Rotor Dynamics—1: Geometric Properties of Rotors | Rasmussen | 2/6 | 142 | (4.0) |
| Practical Rotor Dynamics—Part 2: Load/Deflection Relationship | Rasmussen | 2/20 | 157 | (5.0) |
| Practical Rotor Dynamics—Part 3: Natural Frequencies & Critical Speeds | Rasmussen | 3/6 | 158 | (5.0) |
| Instrument Selection | Tustin | 5/29 | 117 | (9.0) |
| Avoiding Vibration Damage | Tustin | 6/26 | 140 | (4.0) |
| Prognosis With Plastic Models | Wright & Bannister | 8/21 | 135 | (5.0) |
| Missile Maker Minors In Music | N/T | 4/17 | 10 | (0.6) |
| Origins of Noise | Mitchell & Lynch | 5/1 | 174 | (5.0) |
| Fastener Evaluation | Brenner F&J | 9/11 | 24 | (2.6) |
| Stress and Deflection | Krupka & Mutzala | 5/29 | 129 | (4.0) |
| Basic Course in Failure Analysis | Lipson | 10/16 | 146 | (5.0) |
| Planning for Strength | Lipson | 10/30 | 108 | (5.0) |
| Microperformance of Metals | Weinstein | 12/11 | 174 | (8.0) |
| Basic Course in Failure Analysis—Failure Modes | Lipson | 11/13 | 222 | (4.0) |
| Damage-Tolerant Design | Osgood | 10/30 | 91 | (5.0) |
| Sagging Pressure Reveals a Giant Case of Fatigue | Scan | 10/16 | 151 | (1.0) |
| Why Fasteners Fail | CD | 4/3 | 162 | (2.0) |
| Selecting Materials to Resist Fatigue | CD | 9/4 | 150 | (1.7) |
| Laser Provides New Data on Impact | Lavoie | 3/20 | 212 | (3.0) |
| Zero Wear | Eayer, Shalkey & Wayson | 1/9 | 142 | (10.0) |
| Designing for Measurable Wear | Bayer & Wayson | 8/7 | 118 | (10.0) |
| Adhesive and Abrasive Wear | Lipson | 12/25 | 74 | (4.0) |
| Pneumatic Line Losses | Wroten | 12/11 | 182 | (4.0) |
| Damage-Tolerant Design | Osgood | 10/30 | 91 | (5.0) |
| Joint Design | (Chapter) F&J | 9/11 | 12 | (12.0) |
| Designing Tapered Beams | CD | 10/2 | 144 | (3.0) |
| Bending Fractures, Lesson 4 | Lipson | 11/27 | 140 | (4.0) |
| Stress In Noncircular Shafts | Hassoun | 6/24 | 132 | (2.0) |
| Torsional Failures, Lesson 5 | Lipson | 12/11 | 186 | (4.0) |

74. Human Factors Engineering

| | | | | |
|--|------------------|------|-----|--------|
| Machines That Teach—Part 1 | Klein | 5/29 | 21 | (8.0) |
| Feeding People On The Go | Spector | 10/2 | 20 | (10.0) |
| Common Sense Needs An Assist | Straus & Carlock | 6/24 | 102 | (4.0) |
| Human Factors Checked Out In D8SV Test | N/T | 1/23 | 10 | (0.8) |
| Human Factors Experts Probe For New Truck-Cab Efficiencies | N/T | 3/6 | 48 | (1.0) |

| | | | | |
|--|-----------|-------|-----|--------|
| Lifting Rubber Fingers Curl, Squeeze, and Hold | N/T | 10/16 | 10 | (0.8) |
| "Sea of Tranquility" for Earthlings With Ulcers | Scan | 10/2 | 117 | (1.0) |
| Off-The-Shelf Underwater Habitat | N/T | 11/27 | 42 | (1.0) |
| Elastic Dummy Will Eject From Jets | N/T | 12/11 | 10 | (0.5) |
| Product Safety | Wise | 8/7 | 19 | (15.0) |
| Pumped-Up Helmets Guard the Gridiron | (Article) | 10/16 | 36 | (2.0) |
| Greats | N/T | 6/26 | 10 | (0.5) |
| Nobody Knows About Household Accidents When Cars Crash, Bumper Absorbs Collision | N/T | 9/4 | 10 | (1.0) |
| From Door Ramblings, New Safety Standards? | N/T | 10/16 | 14 | (0.5) |
| Commentary Continues | N/T | 12/25 | 8 | (1.0) |
| Books on Tape and TV-Eye Backpack | N/T | 5/1 | 14 | (1.2) |
| Optimizing Working Environments | CD | 11/27 | 150 | (1.7) |
| Automatic Assembly | Scan | 12/11 | 156 | (0.5) |

75. Design Analysis and Synthesis

| | | | | |
|--|---------------------|-------|-----|-------|
| Organizing Design Problems | Burgess | 11/27 | 120 | (8.0) |
| 3-D Graphics | Lavoie | 10/30 | 84 | (7.0) |
| Component Status Chart | Wallenhorst | 11/27 | 111 | (3.0) |
| Product Planning by Computer | Correns | 1/23 | 161 | (2.0) |
| Systematic Subjectivity: Decision-Making With Utility Theory | Schermerhorn & Taft | 2/6 | 122 | (4.0) |
| Analog Simulator | Cook & Hultin | 8/7 | 128 | (4.0) |
| Radio-Control Models | Spector | 11/13 | 20 | (8.0) |
| Hobbies for Engineers: Think Games | Spector | 12/25 | 25 | (3.0) |
| Piggyback Models Mimic Spacecraft | Wood | 1/9 | 40 | (4.0) |
| Prognosis With Plastic Models | Wright & Bannister | 8/21 | 135 | (5.0) |
| Prognosis With Plastic Models | Wright & Bannister | 9/4 | 136 | (5.0) |
| Prognosis With Plastic Models | Wright & Bannister | 10/2 | 128 | (6.0) |
| Prognosis With Plastic Models | Wright & Bannister | 10/16 | 178 | (8.0) |
| Mountain Models: New Tool for Antenna Designers | N/T | 6/26 | 18 | (0.5) |
| Advanced Simulator Files Any Combat Mission Realistically | N/T | 11/13 | 64 | (0.7) |
| Elastic Dummy Will Eject From Jets | N/T | 12/11 | 10 | (0.5) |
| Computer Graphics: | | | | |
| Part 1—The Engineer and the CRT Terminal | Dankowski & Lippert | 4/17 | 226 | (7.0) |
| Part 2—The Problems You Can Solve | Dankowski & Lippert | 5/1 | 148 | (8.0) |
| Computer Matches Designer, Methods Man As Working Team | Khol | 3/6 | 127 | (3.0) |
| From Computer to Microfilm—Nonstop | N/T | 1/23 | 18 | (3.0) |
| Use Your QA Capabilities | Kuhn | 11/13 | 174 | (6.0) |
| Estimating Service Life | CD | 5/29 | 136 | (2.0) |

| | | | |
|---|---------------------------|----------------|--|
| An Aerospace Industry Report on TPDT Systematic Subjectivity: Minimizing Risk Factors in Design | Black Schermerhorn & Taft | 3/20 177 (3.0) | |
| Design for Repairability | Wise | 1/9 120 (4.0) | |
| | | 6/26 20 (7.0) | |

76, 77. Basic Sciences, Experimental, Advanced Design

| | | | |
|---|-------------------|------------------|--|
| The Electric Brain | Khol | 5/29 103 (8.0) | |
| Lunar Experiments Promise Rich Return | Wise | 8/21 30 (4.0) | |
| Supercooled Atom-Smashing Electron Racetrack | Spector | 3/6 42 (1.0) | |
| Supertrap for Invisible Particles | Spector | 12/11 40 (4.0) | |
| Measuring Temperature | Lynnworth & Benes | 11/13 190 (15.0) | |
| Liquid Crystals—A Film In Your Future? | Sproy | 2/6 34 (6.0) | |
| Neutron Radiography | Lavoie | 2/6 138 (4.0) | |
| Pressure Erases Damage To Irradiated Metal | N/T | 4/17 12 (0.5) | |
| "Sea of Tranquility" for Earthlings With Ulcers | Scan | 10/2 117 (1.0) | |
| Oxygen Sniffer | Barnes | 7/10 47 (2.0) | |
| Grafting Men Together Again | Barnes | 8/21 20 (7.0) | |
| Epileptics May Get Attack-Warning Device | N/T | 6/26 12 (0.6) | |
| Spacecraft Sterilizers Set Bacteria-Toasting Standards | N/T | 2/20 18 (0.5) | |
| The Solid-State Cowbell | N/T | 7/10 14 (1.3) | |
| Lifting Rubber Fingers Curl, Squeeze, and Hold | N/T | 10/16 10 (0.8) | |
| New Treatment for Cancer: Ultrasonics, Chilling, and Poison | N/T | 10/30 40 (0.5) | |
| Simple Pump Moves Human Blood | N/T | 12/25 14 (0.6) | |
| Progress In Biomedical Engineering | CD | 1/23 172 (3.0) | |
| What Good Is Holography | Aronson | 1/23 26 (17.0) | |
| Optical Computers | Khol | 8/21 117 (9.0) | |
| Holography: What the Germans Are Doing | Heumann | 9/18 20 (3.0) | |
| Optoelectronics | Khol | 10/16 156 (12.0) | |
| Optoelectronics, Part 2 | Khol | 11/13 208 (10.0) | |

| | | | |
|---|-----|----------------|--|
| Gyro 'Platform' Added To Hand-Held Binoculars | N/T | 1/9 10 (0.6) | |
| Holograms Shrink Computer Memories | N/T | 6/26 10 (0.5) | |
| Foul-Weather Viewer Sees Through Fogs | N/T | 1/9 14 (0.5) | |
| New Treatment for Cancer: Ultrasonics, Chilling, and Poison | N/T | 10/30 40 (0.5) | |
| Ultrasonic Testing of High-Strength Alloys | CD | 3/6 164 (2.5) | |
| X-15: Black Bullet That Paved a Path To the Moon | N/T | 11/27 30 (5.0) | |

78. Environmental Design

| | | | |
|---|---------|----------------|--|
| Weather: The Questionable Art of Alteration | Wood | 3/20 33 (8.0) | |
| Keeping Patient's Pure | Barnes | 4/3 42 (3.0) | |
| Design to Control Corrosion | CD | 8/7 136 (2.3) | |
| The Little Yellow Monster-Chasing Submarine | Spector | 7/10 42 (1.0) | |
| Trip Guide To Apollo 10 | Wise | 5/15 36 (4.0) | |
| Twin Mariners Nearing Mars | Wise | 6/24 20 (3.0) | |
| Elation, Apprehension Stir Scientific Community On Eve of Apollo 11 | Wise | 7/10 36 (4.0) | |
| The Next Big Step: Stations In Space | Wood | 12/25 20 (6.0) | |
| Research Council Calls for More Spending on Satellites | N/T | 3/6 18 (0.5) | |
| Factories in Orbit Won't Lack Work | N/T | 4/17 44 (0.5) | |
| All-Purpose Space Station Planned for M-70s | N/T | 5/15 15 (0.5) | |
| Best Window Opening for Outer-Planet Flybys | N/T | 6/24 10 (0.5) | |
| Modular Space Station Could Grow Into 50-Man Base | N/T | 11/13 12 (0.5) | |
| Astronauts Will Search for Surveyor | N/T | 11/13 49 (1.0) | |
| Human Factors Checked Out In DSSV Test | N/T | 1/23 10 (0.8) | |
| Boom In Bottom Bases | Barnes | 2/6 18 (8.0) | |
| Assault On the Sea | Wise | 4/17 20 (8.0) | |
| Emergency Air System Ready for Rescue Sub | N/T | 5/15 10 (0.5) | |
| Ocean-Bottom Drillers Told to Stay At It | N/T | 11/27 28 (0.6) | |
| Off-The-Shelf Underwater Habitat | N/T | 11/27 42 (1.0) | |
| Weather | Wood | 3/6 19 (14.0) | |

Engineering Management, Personal

81. Engineering Department Operations

| | | | |
|--|------------------|-----------------|--|
| Plan Promotes Productivity | Kahle | 10/2 102 (4.0) | |
| Need-To-Know for the Manager-In-Training | Karger & Murdick | 6/24 98 (4.0) | |
| Lending Engineers | Lavoie | 5/29 92 (5.0) | |
| If You Manage Engineers | Rossmagel | 8/21 107 (5.0) | |
| How To Move Up Without Dropping Out | Taylor | 10/2 98 (4.0) | |
| Abilities Are Applied | (Article) | 11/27 108 (3.0) | |
| What Causes Discontent? | Brown | 12/11 144 (2.0) | |
| The Failure of Functionalism | Brown | 5/15 138 (6.0) | |
| Spark for Keeping a Project On Schedule | D'Aprix | 11/13 180 (3.0) | |
| Bridging the Communications Gap | Carr | 8/7 102 (2.0) | |
| From Your Side | Karger & Murdick | 9/4 104 (4.0) | |
| Help Work for Job Hunting | Strauss | 5/29 97 (5.0) | |
| Paper Engineers Grow | N/T | 3/6 8 (0.7) | |
| What's Your JSQ? | N/T | 8/7 8 (0.7) | |
| Technical Employment Opportunities Show Large Gain | N/T | 5/15 8 (0.8) | |
| Demand Reached New High for Class of '69 | N/T | 7/10 8 (1.0) | |
| Draft Opens Schools To Foreign Engineers | N/T | 10/2 8 (0.6) | |
| Sharpest Rise in Engineers' Pay Posted In 1968 | | | |
| Pay Hike OKed for Federal Engineers | | | |

82-84. New Products, Drafting, Testing

| | | | |
|---|--------------------|----------------|--|
| Plot Control | Aronson | 1/9 22 (9.0) | |
| Product Planning by Computer | Correns | 1/23 161 (2.0) | |
| Ingredients for Successful Proposals | DeGeorge | 4/3 122 (5.0) | |
| Before It's Too Late, Denovate | Spector | 4/3 20 (7.0) | |
| Guidance System for Innovation | Spector | 9/18 26 (5.0) | |
| R&D: Term for Accountants Only | N/T | 6/24 8 (0.7) | |
| Project Task Teams | Stratton | 6/26 102 (5.0) | |
| Eliminating Vanishing-Point Spread | Duncan | 8/21 139 (1.0) | |
| Electric Photographs Developed Without Silver | N/T | 1/9 12 (0.5) | |
| Supercamera Creates Precise Circuit Boards | N/T | 10/16 12 (0.5) | |
| New Techniques in Joining | CD | 8/21 144 (1.5) | |
| From Computer To Microfilm—Nonstop | N/T | 1/23 18 (3.0) | |
| Just the Fax | Klein | 2/20 20 (6.0) | |
| A New Engineering Facility | Goldberg | 3/6 125 (2.0) | |
| Nondestructive Testing | Lavoie | 9/4 121 (15.0) | |
| Prognosis With Plastic Models | Wright & Bannister | 8/21 135 (5.0) | |
| Tire Makers Devise Nondestructive Test | N/T | 8/21 10 (0.5) | |

| | | | |
|---|------|-----------------|--|
| Resistance Wire Cycles Test Load Application | Scan | 1/9 133 (0.7) | |
| Test Chamber Simulates the Rigors of Re-entry | N/T | 3/20 14 (1.3) | |
| Nine-Lane Track Tests New Tires | DI | 11/27 48 (1.0) | |
| Accelerating Lubricants Tests | CD | 10/16 188 (2.2) | |

85. Technical Information

| | | | |
|---|----------|-----------------|--|
| Government Information Sources | Clarke | 10/30 96 (8.0) | |
| Ultrasonic Testing of High-Strength Alloys | CD | 3/6 164 (2.5) | |
| Engineering Standards for Small Companies | Landau | 10/16 140 (6.0) | |
| Read It Like It Is | Ebel | 3/20 175 (3.0) | |
| Building 'Show' Biz Into Technical Talks | D'Aprix | 4/3 127 (4.0) | |
| Speech-Making for the Unaccustomed Engineer | Prahalls | 12/11 146 (3.0) | |

87, 88. Personal, Professional, Outside Services

| | | | |
|---|------------------|-----------------|--|
| How the New Grads Measure Up | Chipman | 9/18 227 (3.4) | |
| Help Engineers Grow | Karger & Murdick | 9/4 104 (4.0) | |
| Noble Motives and Rich Rewards | Khol | 9/18 178 (12.0) | |
| Technology's Privileged Offspring | Klein | 9/18 198 (6.0) | |
| The New Social Involvement | Marlowe | 9/18 218 (2.5) | |
| The Engineer As a Professional | Robbins | 9/18 221 (3.8) | |
| Living With Runaway Technology | Ruder | 9/18 225 (2.6) | |
| Revolution in Engineering Education | Spector | 9/18 190 (8.0) | |
| They'd Rather Stay Than Switch | Tribus | 9/18 215 (3.6) | |
| Shape Up and Act Professional, Designers Are Told | (Article) | 12/25 50 (4.0) | |
| Forcing Ideas With Synectics | N/T | 8/7 42 (0.6) | |
| Ten Draftsmen Honored With Grand Design Awards | Raudsepp | 10/16 134 (6.0) | |
| Are Creative Engineers "More Equal" Than Others? | N/T | 1/9 21 (1.0) | |
| Making Meetings Count | N/T | 7/10 106 (4.0) | |
| Games Engineers Play | Zawacki | 1/23 130 (3.0) | |
| Promote Your Idea | Raudsepp | 2/20 130 (6.0) | |
| Radio-Control Models | Herzog | 3/6 122 (3.0) | |
| International Mechanisms Group Established | Spector | 11/13 20 (8.0) | |
| New Engineering Society Slow Getting Started | N/T | 10/30 42 (0.7) | |
| Wescon Industrial Design Awards | N/T | 11/13 66 (0.7) | |
| | N/T | 8/21 36 (2.0) | |

Specific Machines and Equipment

911. Ordnance

| | | | | |
|---------------------------------------|--------------|-------|-----|--------|
| An Album of Design | (Article) | 9/18 | 214 | (11.0) |
| Riot Control | Aronson | 1/9 | 22 | (9.0) |
| Where Roads Don't Count | Aronson | 5/1 | 36 | (7.0) |
| European Fighter Aircraft | Aronson | 10/16 | 44 | (6.0) |
| New Ideas for Artillery | Aronson | 12/11 | 26 | (2.0) |
| Design for Battlefield Survival | Orgorkiewicz | | | |
| | | 11/13 | 36 | (8.0) |
| New Armor Materials | Orgorkiewicz | | | |
| | | 11/27 | 36 | (4.0) |

912. Machinery

| | | | | |
|---|-----------|-------|-----|-------|
| Mechanizing the Malls | Klein | 3/20 | 20 | (7.0) |
| Universal Power Units | Zimmerman | 11/13 | 52 | (3.0) |
| Safe Power Lawn Mower Throws Debris Forward | N/T | 10/2 | 42 | (1.0) |
| Truck's Load Slides on "Window Shades" | N/T | 11/27 | 14 | (1.3) |
| Air Knives Strip Sterilizer From Milk Wrapper | Scan | 10/2 | 118 | (0.5) |

913. Electrical Machinery

| | | | | |
|---|---------|-------|-----|--------|
| Underwater Watchdogs | Boyd | 5/29 | 31 | (4.0) |
| Multiplexing Takes Off | Klein | 6/26 | 34 | (5.0) |
| The ABCs of CATV | Klein | 11/27 | 20 | (5.0) |
| On the Beat With the Electronic Cop | Spector | 4/3 | 39 | (2.0) |
| The Self-Cleaning Oven Derby | Spector | 4/17 | 47 | (4.0) |
| Feeding People On the Go | Spector | 10/2 | 20 | (10.0) |
| Research Hope to Shock-Proof Radar | N/T | 3/6 | 14 | (0.5) |
| Prototype Ready for Hang-On-Wall TV | N/T | 6/24 | 10 | (0.5) |
| Telephone Pictures Show What Computer Remembers | N/T | 6/24 | 14 | (0.5) |
| Laser Finds Job in Home-Entertainment System | N/T | 10/30 | 12 | (0.7) |
| Coming: The Trash Masher | N/T | 11/27 | 45 | (0.7) |
| Design Program Previews Home Appliances of the Future | N/T | 12/11 | 32 | (2.0) |
| Switch to D-C Leaves Turntable Wowless | Scan | 10/2 | 119 | (0.5) |

914. Transportation

| | | | | |
|---------------------------|---------|------|----|-------|
| Foreign Car Sampler | Aronson | 2/20 | 47 | (4.0) |
| River-Boat Design | Aronson | 7/10 | 20 | (9.0) |

| | | | | |
|--|-------------|-------|----|--------|
| The Zeppelins Are Coming (Again?) | Heumann | 10/2 | 45 | (3.0) |
| The Urban Mobility Hang-Up | Wise | 4/17 | 36 | (6.0) |
| Stripes, Scoops, and Spoilers—Signs of the Swinging '70s | Wise | 9/4 | 20 | (14.0) |
| Andy at Indy | Wood & Wise | 5/15 | 20 | (10.0) |
| Piggyback Models Mimic Spacecraft | Wood | 1/9 | 40 | (4.0) |
| The Automated Sky | Wood | 10/30 | 19 | (9.0) |
| Universal Power Units | Zimmerman | 11/13 | 52 | (3.0) |
| Escape Machines for All Seasons: ATVs | Zimmerman | 12/11 | 20 | (5.0) |
| People-Carrying Cylinders Pop Out of Pneumatic Tubes | N/T | 1/9 | 14 | (0.8) |
| Tampa Solves Terminal Sprawl | N/T | 1/9 | 48 | (3.0) |
| From Junk Cars, India's Tractors? | N/T | 2/6 | 10 | (0.7) |
| Go-Ahead Given on Big Surface-Effect Ship | N/T | 2/20 | 10 | (0.5) |
| Granatelli Goes Conventional, Almost | N/T | 3/6 | 10 | (1.7) |
| Frontier Runways Pose No Problems | N/T | 4/3 | 18 | (0.7) |
| Ford's Maverick: Bred and Built by Computer | N/T | 4/3 | 31 | (1.0) |
| World War II Airplanes Make a Mini-Comeback | N/T | 6/24 | 44 | (0.6) |
| Not a Warmed-Over F-111 | N/T | 7/10 | 44 | (1.0) |
| Return of the Hornet | N/T | 8/21 | 18 | (1.0) |
| Build It, Then Fly It Away | N/T | 9/4 | 12 | (1.0) |
| Air Bag Passes Taxing Tests | N/T | 9/18 | 10 | (0.5) |
| Balloon Floats Downed Pilot Out of Enemy's Reach | N/T | 9/18 | 25 | (0.5) |
| Parentheses Propel Platform | N/T | 10/30 | 34 | (1.0) |
| Braking Study Seeks Best Runway | N/T | 10/30 | 44 | (0.7) |
| Steamer Assaults Speed Record | N/T | 11/13 | 14 | (1.3) |
| Three Aircraft Endurance Records Fall | N/T | 12/25 | 10 | (0.5) |
| Special Holst Serves "Harrier" VTOL | DI | 5/29 | 48 | (0.5) |
| New Fiat Has Front-Wheel Drive | DI | 5/29 | 48 | (0.5) |
| Frankfurt Auto Show Previewed | DI | 8/21 | 41 | (0.5) |
| VW '70 | DI | 9/18 | 38 | (2.0) |
| Holden Hurricane | DI | 10/2 | 34 | (1.0) |
| Italian Luxury Car | DI | 10/2 | 39 | (0.5) |
| Opel Idea Car | DI | 10/30 | 47 | (0.5) |
| Four People-Movers: 30 by Capsule | DI | 10/30 | 50 | (0.7) |
| The Walking Truck | (Article) | 4/17 | 32 | (3.0) |

915. Instruments

| | | | | |
|---|-----------|-------|-----|-------|
| Photo Enlargements in a Minute | Spector | 9/18 | 14 | (1.3) |
| Scanning Electron Microscope | (Article) | 6/24 | 106 | (7.0) |
| Thermistored Nosepiece Makes Breathing Easier | Scan | 11/13 | 188 | (0.5) |

Using the classification system provides nine major (one-digit) classifications, each of which has up to nine (two-digit) sub-classifications. These, in turn, are divided into ten (three-digit) indexing classifications.

Indexing classifications ending in 0 (General) are used to index material concerning several or all indexing classifications ending in 1 through 8. Classifications ending in 9 (Other) are used for material falling within the sub-classification but not within any of the items 1 through 8.

MACHINE DESIGN Subject Classification System

1-ELECTRICAL & ELECTRONIC

11 Motors

- 110 General
- 111 Fractional (less than 1 hp)
- 112 Ac integral horsepower
- 113 Dc integral horsepower
- 114 Universal (dc and ac)
- 115 Multispeed
- 116 Gearmotors
- 117 Torque
- 118 Definite and special purpose
- 119 Other

12 Power Supplies

- 120 General
- 121 Batteries (dry and wet)
- 122 Dc generators, motor-generators
- 123 Ac generators (alternators), motor-generators
- 124 Converters, inverters
- 125 Transformers
- 126 Fuel cells, solar cells, photo cells
- 127 Thermoelectric supplies
- 128
- 129 Other

13 Switches & Relays

- 130 General
- 131 Mechanical (pushbutton, lever, rotary, mercury)
- 132 Thermally operated (thermostats)
- 133 Pressure operated
- 134 Limit
- 135 Proximity, photoelectric
- 136 Stepping
- 137 Relays, circuit breakers
- 138 Motor starters (motor controls)
- 139 Other (reed)

14 Instruments & Controls

- 140 General
- 141 Sensing devices (transducers, thermocouples)
- 142 Solenoids, electric actuators
- 143 Timers, timing motors, delays
- 144 Synchros
- 145 Instrument motors
- 146 Data recorders, readouts, indicators
- 147 Meters, gages
- 148 Servo motors, stepping motors
- 149 Other

2-FLUID POWER

21 Fluids

- 210 General
- 211 Hydraulic fluids
- 212 Coolants
- 213
- 214
- 215
- 216
- 217
- 218
- 219 Other

22 Fluid Conditioners

- 220 General
- 221 Fluid storage (pressure vessels)
- 222 Filters, strainers
- 223 Renovators
- 224 Heat exchangers
- 225 Coolers
- 226 Heaters
- 227 Driers
- 228
- 229 Others

23 Fluid Conductors

- 230 General
- 231 Tubing (pressure)
- 232 Hose
- 233 Pipe
- 234 Fittings
- 235 Joints, couplings
- 236
- 237
- 238
- 239 Other

24 Linear Devices

- 240 General
- 241 Cylinders
- 242 Accumulators
- 243 Intensifiers
- 244 Actuators (bellows, diaphragms)
- 245 Pumps (linear)
- 246
- 247
- 248
- 249 Other

25 Rotary Devices

- 250 General
- 251 Pumps (rotary)
- 252 Fluid Motors
- 253 Air motors
- 254 Compressors

15 Circuit Components

- 150 General
- 151 Resistors (rheostats, potentiometers)
- 152 Capacitors
- 153 Inductors
- 154 Solid-State devices (diodes, transistors, SCR's, rectifiers, semiconductors, integrated circuits)
- 155 Tubes
- 156 Saturable reactors (magnetic amplifiers)
- 157 Fuses
- 158 Lasers, masers
- 159 Other

16 Connectors & Wiring

- 160 General
- 161 Rings, brushes, commutators
- 162 Terminals, binding posts
- 163 Contacts (buttons)
- 164 Plugs, receptacles, connectors
- 165 Wiring (cable, cord, coil, harness)
- 166 Printed circuits, stitched circuits
- 167
- 168
- 169 Other

17 Miscellaneous Components

- 170 General
- 171 Electromagnets, magnets
- 172 Chassis, control panels
- 173 Insulation, encapsulation, shielding
- 174 Cooling elements
- 175 Lamps, lighting elements (fiber optics)
- 176 Heaters, heating elements
- 177 Electric clutches & brakes
- 178
- 179 Other

19 Systems & Assemblies

- 190 General
- 191 Amplifiers, preamps
- 192 Control systems (regulators, numerical control)
- 193 Electronic computers
- 194 Other electronic
- 195 Adjustable-speed drives
- 196 Servomechanisms
- 197 Other electromechanical
- 198 Packaging
- 199 Other

255 Rotary actuators

- 256
- 257
- 258
- 259 Other
- 26 Seals
- 260 General
- 261 Materials seals (O-rings)
- 262 Mechanical seals
- 263 Gaskets
- 264 Wiper rings
- 265 Packings
- 266
- 267
- 268
- 269 Other

27 Valves

- 270 General
- 271 Direction control
- 272 Flow control
- 273 Pressure control (relief)
- 274 Servo valves
- 275 Valve blocks (manifolds)
- 276 Nozzles
- 277
- 278
- 279 Other

28 Instruments & Controls

- 280 General
- 281 Test stands
- 282 Control panels
- 283 Meters, gages
- 284 Switches
- 285 Transducers (to hydraulic)
- 286 Regulators
- 287 Fluidic devices
- 288
- 289 Other

29 Systems & Assemblies

- 290 General
- 291 Industrial hydraulic & pneumatic systems
- 292 Mobile, aircraft, marine
- 293 Hydrodynamic drives
- 294 Hydrostatic drives
- 295 Vacuum
- 296 Lubrication
- 297 Hydraulic, pneumatic computers
- 298
- 299 Other

3-MECHANICAL

31 Power Sources

- 310 General
- 311 Jet engines
- 312 Internal-combustion engines
- 313 Turbines
- 314 Atomic, nuclear power
- 315 Exotic fuel engines (rockets)
- 316 Fuels, propellants
- 317
- 318
- 319 Other

32 Constant-Speed Drives & Transmissions

- 320 General (speed reducers)
- 321 Chain
- 322 Belt
- 323 Friction (ball, disc, wheel, cone)
- 324 Gear
- 325
- 326
- 327
- 328
- 329 Other

33 Adjustable-Speed Drives & Transmissions

- 330 General (speed reducers)
- 331 Chain
- 332 Belt
- 333 Friction (ball, disc, wheel, cone)
- 334 Gear
- 335
- 336
- 337
- 338
- 339 Other

34 Drive Components

- 340 General
- 341 Transmission chain, cable
- 342 Belts, belting
- 343 Gears, gearing
- 344 Sprockets
- 345 Pulleys, sheaves
- 346 Conveyor chain, conveyor cable
- 347 Conveyor screws
- 348

4-ASSEMBLY COMPONENTS

41 Fasteners

- 410 General
- 411 Inserts
- 412 Nuts
- 413 Pins
- 414 Quick operating (panel-type, latches)
- 415 Retaining rings, keys, collars
- 416 Rivets
- 417 Screws, bolts, studs
- 418 Washers, grommets, eyelets
- 419 Other (spring clips, clamps)

42 Springs & Isolation Devices

- 420 General
- 421 Fluid & air springs
- 422 Helical-wire springs
- 423 Leaf springs
- 424 Vibration isolators, mounts
- 425 Hydraulic-damping devices (shock absorbers, snubbers)

5-MATERIALS

51 Ferrous Metals

- 510 General
- 511 Cast iron, malleable iron, cast carbon, alloy steels
- 512 Wrought carbon, alloy steels
- 513 Free-machining steels
- 514 Stainless steels, high alloys, high-temperature steels
- 515 Specialty steels (tool, die, electrical)
- 516
- 517
- 518
- 519 Other

52 Nonferrous Metals

- 520 General
- 521 Aluminum
- 522 Copper, Brass, Bronze
- 523 Magnesium
- 524 Nickel
- 525 Titanium
- 526 Zinc
- 527 Refractory metals (tungsten, tantalum, molybdenum, columbium)
- 528 Precious metals
- 529 Other

53 Plastics

- 530 General
- 531 Thermoplastic plastics (nylon, Teflon)
- 532 Thermosetting plastics (epoxy, phenolic, filled silicones, rigid urethanes)

349 Other

35 Rotational Components

- 350 General
- 351 Antifriction bearings (ball, roller, needle)
- 352 Sleeve bearings (gas, solid-lubricant), bushings
- 353 Flexible couplings, universal joints, flexible shafts
- 354 Torque converters, fluid couplings
- 355 Shafts, axles, splines, pinions, crankshafts
- 356 Clutches, brakes
- 357 Fans, blowers
- 358
- 359 Other

36 Mechanisms

- 360 General
- 361 Cams
- 362 Linkages
- 363 Intermittent-motion (periodic-motion, indexing)
- 364 Three dimensional
- 365 Motion converters (leadscrews)
- 366 Spring motors
- 367
- 368
- 369 Other

37 Controls

- 370 General
- 371 Push-pull
- 372 Transducers (to mechanical)
- 373 Gyros, gyroscopes
- 374 Counters
- 375
- 376
- 377
- 378
- 379 Other

39 Systems

- 390 General

- 426 Mechanical-damping devices
- 427
- 428
- 429 Other

43 Miscellaneous

- 430 General
- 431 Locks
- 432 Nameplates, labels
- 433 Dials, knobs, handles
- 434 Shims
- 435 Enclosures
- 436 Wheels, tires, rollers, casters
- 437 Slides
- 438 Hinges, brackets
- 439 Other

49 General

- 490 General

- 533 Laminated plastics, vulcanized fiber
- 534 Reinforced, filled plastics
- 535
- 536
- 537
- 538
- 539 Other

54 Rubber & Elastomer

- 540 General
- 541 Natural rubber
- 542 Synthetic rubber
- 543 Elastomeric plastics (flexible silicones & urethanes)
- 544 Hard rubber
- 545
- 546
- 547
- 548
- 549 Other

55 Joining Materials

- 550 General
- 551 Adhesives, sealants
- 552 Welding rods
- 553 Brazing, soldering alloys
- 554
- 555
- 556
- 557
- 558
- 559 Other

5-MATERIALS (continued)

- 56 Other Nonmetals**
- 560 General
- 561 Carbon, graphite
- 562 Glass, ceramics
- 563 Refractory materials, mica
- 564 Carbides, cermets
- 565 Mineral & synthetic fibers, felt
- 566 Insulating materials (thermal)
- 567 Wood, cork, composition board, paper
- 568 Chemicals
- 569 Other
- 57 Finishes, Coatings & Lubricants**
- 570 General
- 571 Metallic coatings
- 572 Chemical coatings, electrochemical coatings
- 573 Organic finishes (lacquers, synthetic enamels, paints, varnishes)
- 574 Porcelain enamels, vitreous coatings
- 575 Plastic coatings

6-MANUFACTURING PROCESSES

- 61 Metal Casting**
- 610 General
- 611 Sand
- 612 Shell mold
- 613 Permanent mold
- 614 Centrifugal
- 615 Investment
- 616 Die
- 617
- 618
- 619 Other
- 62 Metal Shaping**
- 620 General
- 621 Forging
- 622 Extrusion, impact extrusion
- 623 Heading, upsetting
- 624 Thread, form rolling
- 625 Powder metallurgy
- 626
- 627
- 628
- 629 Other
- 63 Metal Forming**
- 630 General
- 631 Sheet, plate forming
- 632 Stamping, drawing
- 633 High-velocity forming (explosive forming)
- 634 Spinning
- 635 Roll forming
- 636 Tube forming
- 637 Wire forming
- 638
- 639 Other
- 64 Metal Joining**
- 640 General
- 641 Arc welding
- 642 Gas welding
- 643 Resistance welding
- 644 High-energy welding (plasma, electron beam, explosive bonding)
- 645 Flame cutting
- 646 Brazing
- 647 Soldering
- 648 Adhesive joining, bonding
- 649 Other
- 65 Metal Removal**
- 650 General
- 576 Lubricating materials
- 577
- 578
- 579 Other
- 58 Prefabricated Forms**
- 580 General
- 581 Film, tape, sheet, foil
- 582 Wire, wire cloth, wire rope, cable
- 583 Patterned, perforated, expanded metals
- 584 Laminates (other than laminated plastic)
- 585 Composite materials
- 586 Structures (honeycomb, foam, sandwich)
- 587 Structural shapes (tubing, channels)
- 588 Balls
- 589 Other
- 59 General**
- 590 General
- 651 Planing, broaching
- 652 Lathe, screw machining
- 653 Milling, hobbing, gear shaping
- 654 Drilling, boring
- 655 Grinding, abrasive machining
- 656 Honing, lapping, polishing
- 657 High-energy machining (spark, laser)
- 658
- 659 Other
- 66 Metal Treating**
- 660 General
- 661 Heat treating
- 662 Surface treating (carburizing, nitriding)
- 663 Shot peening, surface working
- 664 Chemical milling, etching
- 665
- 666
- 667
- 668
- 669 Other
- 67 Finishing**
- 670 General
- 671 Chemical, solvent cleaning
- 672 Mechanical finishing
- 673 Conversion coating (anodizing) electro-polishing
- 674 Electroplating, vacuum metallizing
- 675 Metal spraying (flame spraying), hard facing
- 676 Painting
- 677
- 678
- 679 Other
- 68 Plastics & Rubber Processes**
- 680 General
- 681 Molding
- 682 Extrusion
- 683 Sheet forming
- 684 Laminating
- 685 Casting
- 686 Stamping, machining, fabricating, forming
- 687 Calendaring, coating
- 688 Encapsulation
- 689 Other (filament winding)
- 69 General**
- 690 General

7-DESIGN THEORY & TECHNIQUES

- 71 Mechanics**
- 710 General
- 711 Statics (at rest)
- 712 Dynamics (force to create motion)
- 713 Kinematics (motion in abstract)
- 714 Vibration
- 715 Shock
- 716 Noise, sound, music
- 717
- 718
- 719 Other
- 72 Strength of Materials**
- 720 General
- 721 Elastic theory
- 722 Plastic theory
- 723 Fatigue, endurance
- 724 Creep
- 725 Impact stress
- 726 Thermal stress
- 727 Friction
- 728
- 729 Other
- 73 Strength of Parts**
- 730 General
- 731 Tension, compression
- 732 Bending
- 733 Shear, torsion
- 734 Surface contact stress
- 735 Plates
- 736 Cylinders, columns
- 737 Rotating discs
- 738
- 739 Other
- 74 Human-Factors Engineering**
- 740 General
- 741 Styling
- 742 Color
- 743 Safety
- 744 Illumination
- 745 Human limitations
- 746
- 747
- 748
- 749 Other

7-DESIGN THEORY & TECHNIQUES (continued)

- 75 Design Analysis & Synthesis**
- 750 General
- 751 Mathematical methods (statistics)
- 752 Graphical techniques
- 753 Analogs, models
- 754 Computer techniques
- 755 Reliability, quality control
- 756 Dimensioning (tolerances)
- 757
- 758
- 759 Other
- 76 Basic Sciences & Fields**
- 760 General
- 761 Physics
- 762 Chemistry
- 763 Thermal (cryogenics, heat transfer)
- 764 Radiation
- 765 Biosciences
- 766 Optics (photography)
- 767 Ultrasonics
- 768
- 769 Other
- 77 Experimental Design**
- 770 General
- 771 Prototypes, breadboards
- 772 Testing (stress analysis)
- 773
- 774
- 775
- 776
- 777
- 778
- 779 Other
- 78 Environmental Design**
- 780 General
- 781 Corrosion, rust
- 782 Mold, fungus
- 783 Outer space
- 784 Under sea
- 785
- 786
- 787
- 788
- 789 Other
- 79 General**
- 790 General

8-ENGINEERING MANAGEMENT & OPERATION

- 81 Engineering Department Operations**
- 810 General
- 811 Structure, organization
- 812 Costs
- 813 Programming, planning
- 814 Personnel policies
- 815 Recruiting, evaluation, training
- 816 Managerial talent
- 817 Compensation
- 818
- 819 Other
- 82 New Product Development**
- 820 General
- 83 Drafting & Reproduction**
- 830 General
- 831 Management, control systems
- 832 Drafting practices, techniques
- 833 Technical illustration
- 834 Drafting equipment
- 835 Reproduction equipment, systems
- 836 Furniture
- 837
- 838
- 839 Other
- 84 Laboratory & Testing**
- 840 General
- 85 Technical Information**
- 850 General
- 851 Engineering libraries, files
- 852 Information classification, retrieval
- 853 Specifications, standards
- 854 Report writing, articles, papers, oral
- 855 Part numbering
- 856 Engineering records
- 857
- 858
- 859 Other
- 86 Patents & Patent Law**
- 860 General
- 87 Personal & Professional**
- 870 General
- 871 Creativity, inventiveness
- 872 Meetings, shows
- 873 Other personal
- 874 Societies
- 875 Professional licensing
- 876 Unions
- 877
- 878
- 879 Other professional
- 88 Outside Services**
- 880 General
- 881 Engineering design services
- 882 Industrial design services
- 883
- 884
- 885
- 886
- 887
- 888
- 889 Other
- 89 General**
- 890 General

9-MISCELLANEOUS

- 91 Complete Machines**
- 910 General
- 911 Ordnance (tanks, missiles, rockets, ammunition, SIC 19)
- 912 Machinery (agricultural, construction, machine tools, office machinery, materials handling, SIC 35)
- 913 Electrical machinery (communications, radio radar, TV, appliances, X-ray, SIC 36)
- 914 Transportation (automotive, aircraft, ships, railroad, SIC 37)
- 915 Instruments (medical, dental, photographic, watches, SIC 38)
- 916 Fabricated metal products (hand tools, etc., SIC 34)
- 917
- 918
- 919 Other
- 99 Unclassified**
- 990 General (includes pages such as Editorials, "Back Talk," Covers, Contents Pages, etc.)

